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THE LONDON NATURALIST

The Journal of the
LONDON NATURAL HISTORY SOCIETY

No. 40 for **1960**

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Published July, 1961



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Council's Report for 1960

JUST as 1959 was one of the finest summers on record, so 1960 brought unprecedented rainfall. There was, however, a fine spell in the spring and early summer; this succession of prolonged sun, winter rain and a bright spring favoured the blossom and resulted in a huge crop of fruit and berries, undoubtedly the feature of the countryside in 1960.

The uncertainty of the weather affected the attendance at the Society's meetings, both in the field and indoors, and hampered the work of the Sections in general. However, the Society's membership was reasonably well maintained and we look forward with confidence to the future.

It is particularly gratifying to record the growth of the Young Naturalists' Section which now has a membership of 160, nearly all of whom are active members. The Section caters equally for those of school age and for those in their late teens and early twenties; the members provide their own officers and are in complete charge of their own meetings, but many senior members of the Society have helped in one way or another, by giving advice, leading field meetings and speaking to the well-attended informal indoor meetings. A survey is in progress of foxes and badgers in the area and a number of our young people have taken part in the work of the Conservation Corps of the Council for Nature. Several Youth Hostelling week-ends have been held, and the Section provided the Society's representation at the annual camp of the International Youth Federation for the Study and Conservation of Nature. We have dealt at some length with the success of the new Section in view of its importance for the future of the Society, and for the young people themselves.

Throughout the year the Society has continued to study and record the works of nature in the London area, that is, within 20 miles of St. Paul's Cathedral. Members have been encouraged to take part in individual recording and in corporate studies, with opportunities to learn and so increase the effectiveness of their work. Informal meetings of the Sections at Eccleston Square provide an opportunity for members to meet each other, to exchange information and to demonstrate techniques. The Society has again collaborated with the University of London in arranging evening classes, this year in Botany, Geology and Ornithology. These lecture courses have been well attended and have reached a high standard; yet it has been found that people who are comparatively new to the subject have been able to understand the lectures and acquire a sounder scientific basis for their natural history than would have been possible a decade or two ago. Many of the Society's active workers have taken advantage of the courses and others have become more active in the Society since joining a class. A valuable feature is that, meeting week by week, our members get to know each other and the resulting friendships are a real contribution to the life of our Society.

Turning to the work of the Sections, the Botany meetings continue to be well attended. Special mention must be made of the interest shown in the more specialized botanical subjects both in the Society's meetings and in the short courses of lectures arranged by the University of London, in algae, fungi and bryophytes. The paper by D. H. Kent on the Flora of Central London, published in the *London Naturalist* for 1959, was well reviewed and attracted attention from the general public.

The Ecology Section has continued the Survey of Bookham Common,

now the subject of an experiment in the control of vegetation, sponsored by the Nature Conservancy and put into effect by the Conservation Corps of the Council for Nature. The Section's indoor meetings attract many whose main interests lie in other Sections and help to broaden one's understanding of nature as a whole. Meetings of the Mammal Study Group, held under the auspices of this Section, have again proved popular.

In Entomology, the Stag Beetle survey has been continued and from the larger response this year it appears that the distribution of the insect is wider than previous records had suggested.

Once again the highlight of the Geologists' year has been the successful long week-end spent in the Midlands and Derbyshire at Easter. A wider choice of subjects for field meetings seems to be encouraging more members to take part; it is pleasing to see this trend since geology is fundamental to so many studies in natural history.

Under the auspices of the Ornithological Research Sub-Committee an intensive early-morning migration watch was organized in the area by Ian Wallace and Tony Gibbs during October and November. A large number of record sheets was received and at the time of writing they are still being sifted and collated; it is already evident that much useful information has been obtained about visible migration in the London area.

The colour film of bird life in London is another spectacular activity of the Section. More than two thirds of it have already been exposed and editing is in progress. Short lengths have recently been shown on television.

Other ornithological work includes a study of birds at rubbish tips, a source of food which is thought to have influenced bird populations, particularly of wintering gulls.

The *London Bird Report* for 1958 appeared in January, 1960, and good progress has been made with its successor which was virtually complete at the end of the period under review but which, for economic reasons, was again sent out with the programme in January, 1961.

The *Bulletin* of the Ornithological Section is circulated six times a year bringing news of birds in the area and of what is happening in the Section. There has been a welcome increase in news sent by members to the Editor.

The Beddington Ringing station had another successful year and altogether has now ringed over 10,000 birds. B. S. Milne, the leader of the Beddington team, has published a paper in the magazine *British Birds*, based on his studies of the Yellow Wagtail made at Beddington. R. E. Scott, who was one of the first members of the Beddington team and obtained much of his experience there, was in March, 1960, appointed Warden of the Dungeness Bird Observatory and of the R.S.P.B. Reserve.

The Archaeology Section, which two years ago embarked on field research in addition to its accustomed study of historic buildings, has made further progress in tracing the course of Roman roads in the London area. A paper by D. J. Turner on the excavations on Stane Street at Morden was published in the *London Naturalist* for 1959. The Section now holds informal meetings once a month and occasional extra meetings on Saturdays; the enthusiasm and team spirit which is evident in the Section promises well and now that firm foundations have been set for practical work the Section is seeking to expand its membership. Several "digs" have been planned for 1961, including one of a week or ten days at Easter and a week-end "dig" later in the year.

The Administration and Finance Committee has undertaken the redecoration and refurbishing of the rooms at Eccleston Square. The Library has been re-housed in unit construction cases which allow more room for books and yet occupy less space in the room. The cases were bought from a legacy which the Society received from the late C. L. Collenette, and this is recorded on a plaque which has been placed in the Library. The Collections room has been laid out in a way which will allow informal and committee meetings to be held in it, and a projection screen has been incorporated above the fireplace. The whole operation was under the control of Mrs. L. M. P. Small and in addition a tremendous amount of hard work and ideas came from B. L. J. Byerley, J. Graham Harvey and Mrs. Trenamen, with help from Miss J. Small and Messrs. Tarrant, D. G. Hall, Hyatt and LeGros. To these, to others who helped, and to the Lewisham Natural History Society which provided all the effort for one evening of furniture moving, Council expresses its grateful thanks.

At 31 October, 1960, the Society had 1,517 members, rather fewer than a year ago. The drop can be attributed in part to the rise in subscriptions on 1 January, 1959, the effect of which is still being felt.

Council accepts the fact that in London a floating membership is inevitable and therefore the drive to bring in new members must be continuous. Although the Society obtains publicity in various ways the most effective recruitment comes from the personal efforts of members, to each of whom Council appeals once again to bring at least one new member during the year.

The Society gratefully acknowledges the receipt through the Royal Society of a Parliamentary grant-in-aid of £65 towards the cost of publishing papers by C. P. Castell and J. E. Lousley in the *London Naturalist* for 1958.

A search for a new meeting place for the Society has ended with the choice of the halls at the new Holborn Borough Library in Theobalds Road, a really modern building with the required facilities, and easily accessible. All lecture meetings will be held there from March, 1961.

E. B. Bangerter completed his second year as President, a year which, in spite of the weather, can be regarded as one of satisfactory progress. J. B. Foster, who was President during the war years and who in 1956 returned to active service as the Society's librarian, has relinquished that office and has been invited to become an Honorary Vice-President. Council has also decided to bestow Honorary Membership on Mrs. Collenette, the widow of C. L. Collenette who died in 1959.

This year Council has to express its sorrow on the death of the following members:—Miss N. H. Coates, H. S. Cornwall, F. J. Barrington, F. Littlewood Moore, D. A. T. Noake, P. Murphy, Miss J. Paton and F. R. Mann. Miss Coates and Dr. Barrington were members of very long standing, and Mr. Mann took an active part in the work of the Ornithological Section until a year or two ago.

Finally, it is appropriate to end this report with a word of praise and grateful thanks to Mrs. Small for the immense amount of work she has done in the day-to-day running of the Society, as secretary of the A. and F. Committee and in superintending the improvements at Eccleston Square.

The Botany of the London Area

By E. B. BANGERTER

(PRESIDENTIAL ADDRESS, DECEMBER, 1959)

INTRODUCTION

In attempting to survey in one short hour the botany of so large an area as ours—1,200 square miles—I am constrained to find a limiting theme for this address, which with great boldness I offer as a memorial to those stalwarts of the past who set our high standards and, with even greater humility in view of my own insignificant part, as a tribute to the present workers who maintain those standards so well. My theme, in fact, is the contribution of our Society to the study and knowledge of the vegetation of our own area. My main source of information is our own journal, *The London Naturalist*, but to do justice to my subject I have had recourse to the work of our members and others in other publications. Inevitably much will be omitted and I apologize now to any worker who may feel ignored.

HISTORY

One publication which should not be ignored is R. S. R. Fitter's *London's Natural History* in Collin's New Naturalist series, both because the author expresses his great debt to the recording activities of his fellow-members and because he tells a graphic story of changing natural history in a rapidly spreading city. He expresses his opinion in some instances, however, that the city's botanists have not always taken full advantage of their opportunities; since the publication of his book in 1945 much significant work and many interesting papers have been produced which I am sure provide an answer to such criticism. We learn from Fitter how the North Downs of Surrey and Kent, the Chilterns of Hertfordshire and the chalk of Harefield in Middlesex were laid down in the Cretaceous period when our area was under a vast sea. We learn, also, how in later periods the London Clay and subsequent cappings of gravel and sand were deposited to give the area its variety of soils.

At this point I leave Fitter to introduce C. P. Castell, who in his Presidential Address *The Climate and Vegetation of the London Area in Prehistoric Times*, published in *Lond. Nat.*, for 1958, unfolds a fascinating tale of the alternation of temperate with arctic-alpine floras as interglacial periods alternated with the glacials. Half-a-million years ago, he says, the flora of the London Area was much the same as now—perhaps a little more luxuriant—but the present flora itself did not begin to develop until a mere 10,000 years ago. The plants were their own recorders, setting themselves down as fossils, for instance, in the gravel terraces cut through the ages by the Thames and the Lea. Stoke Newington may have achieved some historical fame as the first site of the L.N.H.S. Centenary Exhibition but it has a greater claim to prehistorical eminence as the site of an excavation from which we know that alder, birch, pine, yew, elm, grasses, sedges and two ferns, the male and the royal, existed in the London Area in the Old Stone Age. Castell further tells us of the work of those famous palaeobotanists, Warren, Chandler, Reid, Allison and Godwin on the Lea Valley beds where an arctic-alpine London flora of some 150 species was identified—mostly now northern plants, some extinct in these

islands and a few surviving in our area. This tundra-type vegetation existed in the last of the glaciations, when the ice was no nearer than 100 miles away and the time just about the 10,000 years ago mentioned by Castell, who concludes by handing us over to F. Rose in the *London Naturalist* for 1956.

In the first part of his paper, *Vegetation History and Environmental Factors in the London Area*, Rose gives some account also of the Lea Valley beds and then takes us rapidly through succeeding ages indicating the development of forest, birch and pine first and later mixed oak with much marshland left along the river valleys. Gradually, as the Stone, Bronze and Iron Ages evolved, the influence of man became more and more marked, particularly with the use of the iron axe to clear the denser forest land.

Here we return to Fitter, who guides us through the period from the foundation by the Romans in A.D. 43 of the city on the twin hills by the Wallbrook, through the Middle Ages, to the swelling and bursting of Cobbett's "Wen". Particularly we note *en route* the maintenance of woodlands in mediaeval times for hunting—relics of which still exist at Epping and elsewhere—and the keeping of herb-gardens by the apothecaries of the 16th-18th centuries, who were our first recording botanists.

Botany, indeed, during this latter time was in the hands of physicians and apothecaries, who often wrote and published Herbals as the medicas guides of their age. Potted biographies of these eminent figures of the past may be found in the botanical histories given in the county Floral of Middlesex by Trimen and Dyer (1869), Herts. by Pryor (1887), Essex by Gibson (1862), Kent by Hanbury and Marshall (1899), Bucks. by Druce (1926) and Surrey by Salmon (1931). To name a few from many we have William Turner, the "Father of British Botany", responsible for many first British as well as London records; John Gerard, who added 73 species to the Middlesex list; Thomas Johnson, who gave us the first published account of a London botanical excursion, to Hampstead in 1629; Christopher Merrett, early recorder of the London rocket (*Sisymbrium irio*) after the Great Fire of 1666. Of the eighteenth century apothecary-botanists two have caught the interest of two of our leading amateur botanists of to-day, one my predecessor and the other my successor as Chairman of the Botanical Section. In *Watsonia* 1949 (the journal of the Botanical Society of the British Isles), the former, D. H. Kent, gives us some new facts on the life of John Blackstone, a diligent student particularly of the flora of Harefield, of which he wrote an account in 1737 and where he found the very local coral-wort (*Cardamine bulbifera*). The latter, J. E. Lousley, honours the memory of William Curtis in the *London Naturalist* for 1945, the year of Curtis' bicentenary. To us this famous botanist is most interesting as the author of the 72 folio numbers of the *Flora Londinensis*, the somewhat tragic story of which is well worth the reading. He had previously in 1774 issued a *Catalogue of Plants growing wild in the environs of London* and subsequently in 1792 he published an abridgement of the *Flora Londinensis* with reduced plates and of London plants only whereas in the major work he had gone further afield; Battersea Fields and Lambeth marsh especially attracted him as localities. In a short but informative paper in the *Lond. Nat.* for 1949 Kent describes the unhappy loss of a former botanical area, Tothill Fields, Westminster, where many of the above gentlemen and others such as Doody, Petiver and Buddle used to botanize; alas, the area, not long before our Society

came into being was finally buried under a "deluge of bricks and mortar".

Our Society was born, thus, during a deluge that has flowed continuously and often overwhelmingly ever since, but let it not be thought disastrously. In an optimistic paper, *Changes in the flora of the London Area since 1858*, in the centenary number of the *Lond. Nat.*, Lousley, having discussed the localities and plants available to botanists 100 years ago, is able to conclude that to-day's botanists have equal and sometimes even better opportunities. Building inevitably destroys habitats; activities such as quarrying, draining, dumping, road-and-railway construction and even bombing mean changed rather than lost habitats. The outlying districts, more easily accessible by modern transport, have often as rich a flora now as then; the uncommon species of Keston Bog, for instance, number one more in 1957 than in 1860. For his early information Lousley turned to the *Phytologist*, "a chatty monthly periodical", edited by Alexander Irvine, who in 1838 had produced *The London Flora*, which, however, took in most of S.E. England. It was arranged according to both the Natural and Linnean Systems, unlike Daniel Cooper's *Flora Metropolitana* published two years previously, and arranged topographically taking in districts 30 miles from London and concentrating rather on Kent and Surrey. *A New London Flora* by de Crespigny combines the two arrangements, having both systematic and topographical lists and, again, reaching beyond our confines. It appeared in 1877, nearly 20 years after us but, we must confess, before we began botanical recording in earnest.

HABITATS

It was not, in fact, until after the twentieth century had begun that we set down our finds in permanent print, but before I consider this most important aspect of our work I would like to reconnoitre the terrain which is open to us. To do this I enlist the aid of J. H. G. Peterken, who in his Presidential Address in *Lond. Nat.* for 1952, *Habitats of the London Area*, defined the main habitat types which occur within the circle of 20 miles radius from St. Pauls. In giving specific examples from the full account he presents, I select localities visited by myself on Society's excursions. Of woodlands the pedunculate oakwood, as at Epping in Essex, Broxbourne in Herts., Ruislip in Middlesex, Abbey Wood in Kent and Bookham in Surrey, is predominant. Sessile oakwood occurs mainly in the south, at Chipstead in Surrey and Farningham in Kent. The southern chalk of Kent and Surrey bears some beechwoods, for instance on Box Hill, which are the only homes for some of our orchids and in the north, again at Epping, we find good hunting ground for autumn fungi. The small piece of Bucks. in our area has planted pinewood at Black Park. Yew wood is also southern at Mickleham and Norbury Park in Surrey. Birchwoods are abundant as the seral or intermediate stage towards climactic oakwood. Heathland is exemplified on many of our commons such as Wimbledon in Surrey, Hayes in Kent, with remnants or patches in Epping Forest and Hampstead Heath, the latter in Middlesex. Chalk grassland is again mainly in the south, on the North Downs, where I have explored it at Shoreham in Kent. Our rivers, both on their banks and in the alluvial meadows around, provide habitats for many attractive aquatics, as by the Kentish Darent and among the network of canals and rivers on the Middlesex-Bucks. border. Freshwater marsh is at Holwood Park in Kent and by Ruislip Reservoir in Middlesex. Ponds, lakes and reservoirs are abundant but bogs few—Keston Bog, Kent and Farm Bog,

Wimbledon in Surrey being famous. The eastern saltmarshes of the tidal Thames give London its maritime flora, which I have visited at Erith on the Kentish side and West Thurrock on the Essex. Artificial habitats, so often producing the unexpected, include hedges, roadside verges, arable fields, chalk, gravel and sand pits, walls (homes of the delightful mural ferns), waste ground and rubbish tips, where the alien finds settlement, and the bombed sites. It is not my purpose to trespass too far on the ecologist's preserves but here I bring the second part of Rose's paper to the attention of my ecologically-minded fellow botanists, who may correlate Peterken's habitats with the factors affecting them—climatic, mainly microclimatic in our case; edaphic, primarily concerned with calcifuge versus calcicole; and biotic, mostly of course concerned with man's activities.

TOPOGRAPHICAL STUDY

Our documentation of this rich and varied territory has been achieved by long-term ecological surveys, by historical and floristic accounts of particular localities, by the systematic study of particular plants or groups of plants and by organized recording. It is in the consideration on a topographical basis of the first two of these categories together that I am most keenly aware of the limitation of my theme. In appraising our own endeavours I can do no more than touch my hat, as it were, in acknowledgment to other workers and other Societies whose areas fall within or overlap ours, with but a brief mention of published material where it seems imperative as, for example, to the short summary of an address by the late A. J. Wilmott in the *Trans. S.E. Union of Sci. Societies*, 1932, entitled *The London Flora*. He exemplifies the different types of vegetation to be found on the various soils, mentioning the interesting species involved; *Scirpus* \times *carinatus*, a hybrid, was the most interesting left in the area, he says, but I am afraid that it is no longer on the Thames-side. If, by the way, there should be a keen bibliographer among us he could do no better than prepare supplements to Fitter's index to our papers in the *Lond. Nat.* for 1952 and Kent's botanical abstracts in the *Lond. Nat.* for 1949.

1. SURREY

The spacious commons and colourful chalkland of the county of Surrey attract the rambler, hiker, picknicker and, not least, the naturalist. In the south-west of our area certain changes drew observations from H. J. Burkill; in the *Lond. Nat.* for 1925 he notes that clearance of pine at Black Pond, Esher, allowed invasion of silver birch at the expense of others like bog-pimpernel (*Anagallis tenella*); in the *Lond. Nat.* for 1934 he is interested in the non-aquatic species appearing in the dried-up bed of the River Mole near Norbury Park. A list of 33 species was recorded by R. W. Robbins in the *Lond. Nat.* for 1936 for a bracken area on Epsom Common, of which, incidentally, a Flora was published in 1917 by T. N. H. Smith-Pearse. On the extreme edge of our area lies Box Hill, which boasts a rich moss flora; E. C. Wallace in the *Lond. Nat.* for 1954 gives an ecological account of these bryophytes. Here I must mention Lousley, who gives two excellent chapters on the plants and ecology of the Hill in his *Wild Flowers of the Chalk and Limestone* (Collins, 1950). Moving a little to the north-west we come to Bookham Common, 380 acres of (as we have seen) pedunculate oakwood and wet grassland, which have been the

subject since 1941 of our longest ecological survey. This survey, as others, I must deal with as briefly as possible, treating them as team projects, mentioning new workers only, except to pay tribute to the indefatigable Castell, who has taken part since its inception and produced papers on the ponds, the fungi, the bomb-craters and, in collaboration with A. W. Jones, notes on the vegetation of Eastern Plain and with myself on the gun-pits. *The Flora of Bookham Common*, of some 500 species of flowering plants and ferns, was published in the *Lond. Nat.* for 1953 by A. W. Jones, who acknowledges the help of Mr. and Mrs. P. C. Hall, Castell and myself. The woodlands received early attention from B. Steele (*Lond. Nat.* for 1946) and grassland vegetation later consideration from E. W. Groves (*Lond. Nat.* for 1958). A. H. Norkett dealt with the *Algae* in *Lond. Nat.* for 1948. The Lichen flora of 73 species—rich for the London Area—receives ample justice from J. R. Laundon in the *Lond. Nat.* for 1957.

To move further north to another Common, Wimbledon (of which a Flora was compiled by A. A. Pearson in 1918) we find in the *Lond. Nat.* for 1954 another paper by Jones, on the ecology and floral complement (83 species) of its golf course. Pausing on our northward journey at Richmond Park, we find in the *Lond. Nat.* for 1936 that C. L. Collenette pleads for the preservation of bracken as bird cover and that in the *Lond. Nat.* for 1947 he records 10 species of ferns. Continuing north to within six miles of Piccadilly Circus we halt at Barnes Common, to the present flora of which we are introduced by Mrs. M. Whitehouse in the *Lond. Nat.* for 1951; drier than formerly, the Common still possesses species which Paley in his 1882 list prophesied as doomed; the discovery of the grass, *Cynodon dactylon*, is of special interest. Let us now move right across to the north-east tip of Surrey, to the borough of Camberwell and the London Clay; Lousley's persistent and perceptive pen in the *Lond. Nat.* for 1958 draws an extensive and exhaustive picture of the flora of some private grounds, Dulwich Woods, relics of the Great North Wood; his species list is remarkably long for a locality only six miles from St. Pauls. Going southwards again to the edge of our area and the borders of Kent, to Limpsfield Common, we make a long trip, acknowledging gratefully the work of the Croydon Nat. Hist. Society as we pass through their territory. Our Society announced in 1936 the commencement of a survey of Limpsfield, some 140 acres of greens and common. R. W. Robbins undertook the Flora and published in 1938 and 1939 a list of about 400 species; bryophytes, fungi (including *Mycetozoa* or slime fungi by J. Ross) and lichens were all studied and recorded. The survey was abandoned during the last war when Bookham took its place. With the recent acquisition of Lower Wood sanctuary, Claygate, we have opportunity for future work.

2. ESSEX

An equally popular rendezvous for the pleasure-seeker and the naturalist is Epping Forest in Essex. As early as 1915 Robbins wrote the Flora for our *Transactions*, giving the main natural divisions as damp clay woodlands of hornbeam and oak; dry woodland on sand and gravel of beech and birch and open heathy ground; he adds 25 species to E. N. Buxton's list of 1884 showing 436 species; few aliens are recorded but many interesting aquatics and ferns* occur. Later, in the *Lond. Nat.* for 1924 J. Ross gives 30 species of hepatics. In 1942 the then Chingford

Branch began a survey of a representative area of the Forest, the Cuckoo Pits, embracing ponds, woodlands and open ground: 150 species are tabled, followed by lists of mosses, liverworts and mycetozoa. D. J. Boatman in the *Lond. Nat.* for 1948 shows that birch, after a herb invasion is a ready colonizer of cleared areas in his study of the early stages of regeneration of woodlands. The ecological findings of the survey inspired a paper on *Some aspects of dispersal and succession of plants in some Epping Forest Ponds* from C. H. Selby in *Lond. Nat.* for 1954. Work on other localities in our part of Essex must be sought in the *Essex Naturalist* and other publications, not forgetting the historic *Plantae Woodfordienses* by Richard Warner as long ago as 1771. A second edition was contemplated by that great Essex botanist, Edward Forster, who lived in the second half of the 18th and first of the nineteenth centuries and whose herbarium of Epping and Walthamstow plants is in the British Museum Herbarium.

3. KENT, HERTFORDSHIRE AND BUCKINGHAMSHIRE

Little has been published by our members on localities in the counties of Kent, Herts. and Bucks. The richness of our part of Kent, boasting no less than 21 species of orchids, is indicated by the long list of interesting *Botanical Records for Metropolitan Kent 1942-9*, given by Rose in the *Lond. Nat.* for 1949, where he points out the variety of soil—chalk grassland, saltmarsh, alluvial meadow, chalk and clay woodlands, bog and heath. He announces the preparation of a new *Flora of Kent* to replace the old one by Hanbury and Marshall. Apart from this paper and our records, information is to be sought elsewhere than in the *Lond. Nat.* St. John Marriott's *British Woodlands as illustrated by Lessness Abbey Woods*, 1925, is a classic ecological study of these woods near Erith. Kentish local Floras seem to abound but few refer to the metropolitan area; the districts of Greenwich and Bromley have been the subjects of two early lists in 1858 (Greenwich Nat. Hist. Club) and 1898 (Scargill) respectively. Our portion of Hertfordshire presents much the same picture: J. G. Dony has published for us in the *Lond. Nat.* for 1958 *Some Hertfordshire Plant Records*; much of the area, except for a belt of woodland is built up, he says, and many of the records are of alien species but nevertheless interesting. The woodlands have been dealt with to a great degree by E. J. Salisbury in several papers, notably *The Oak-Hornbeam Woods of Hertfordshire* in the *Journal of Ecology*, 1916. Buckinghamshire remains our comital cinderella, having no papers in the *Lond. Nat.* and being lumped with Middlesex by Nicholson in an early recording account.

4. MIDDLESEX

The county of Middlesex lies wholly within our area; consequently Trimen and Dyer's *Flora* is wholly applicable. It may profitably be consulted for much historical information and is still relevant to some degree floristically; nevertheless, for an area covering, botanically at least, the City of London and its expanding suburbs, it is well out of date. The authors give 859 species of flowering plants and ferns as their total, a vast increase on the meagre 144 given by Turner and Dillwyn in their early

* Subsequent to the reading of this paper R. M. Payne has published *The Ferns of Epping Forest* in *Lond. Nat.* for 1959.

Botanist's Guide of 1805. A potential new *Flora* is in the hands of D. H. Kent, whose manuscript, I sincerely hope, will be put into print before too long. His accountancy of the floristic record of his county has been stated in *Notes on the Flora of Middlesex* 1939-46 in the *Lond. Nat.* for 1946 and *Middlesex Plant Records* 1947 and 1948 in two consecutive *Lond. Nats.* in all of which new and interesting finds are recorded and discussed; he particularly appreciates the co-operation of Mrs. B. Welch, his fellow-member. Later, in two numbers of *Watsonia*, he gives *Additions and Corrections to the Comital Flora for Middlesex* 1 and 2 (1949, 1951), in the second of which he acknowledges my association with him in working on London Area plants at the Department of Botany, British Museum (Natural History). In the last-mentioned of his *Lond. Nat.* papers he lists 49 species believed to be extinct at that time and not likely to be refound except as casual introductions. The extinct species of Middlesex is the main theme of a paper in the *Lond. Nat.* for 1915 by C. E. Nicholson on *The Botany of the District* (then north of the Thames only), who gives 58, one more than given by Trimen and Dyer in 1869; Salisbury manages to reduce this to 54 in a list reproduced as an Appendix to Fitter's *London's Natural History*. Lousley points out that these figures are misleading as the later merely followed the earlier writers and that recent recording has put one third of the species back on the Middlesex list. Examples from my own experience are: *Corydalis claviculata*, named by me from a bombed-site plant and *Oenanthe lachenalii* seen by me on a rubbish-tip, but in these habitats the definition "casual" may well apply. Another example is *Cyperus fuscus* rediscovered by T. Dupree in the Staines area, formerly recorded from Eel Brook Common in 1819 and the subject of a note by Kent in the *Lond. Nat.* for 1957. An extremely rare adventive in our area is *Herniaria glabra*, discovered on a disused car park at Kenton and documented by Kent in the *Lond. Nat.* for 1950. In *Watsonia*, 1950, he published *Notes on the Flora of Kensington Gardens and Hyde Park* and, since this Address was read, *A Contribution to the Flora of Central London* in last year's *Lond. Nat.*; both of these showing that we have interesting plants in the heart of the City itself.

Apart from Kent's work on the Middlesex flora, we have the excellent record by our members of the plants found on the bombed sites during the City Bombed Sites Survey commenced in 1947. The building up of the vegetation is well demonstrated and skillfully illustrated by F. E. Wrighton in a series of notes on the plant ecology of the Cripplegate sites. In the *Lond. Nat.* for 1957 Jones collates information and records to provide the *Flora of the City of London Bombed Sites*, in which he analyses the species according to the agencies of distribution—wind, horses, birds, human food and so on, arriving at a total of over 300 species. This agrees very well with the 269 species listed in the brochure *The Natural History of the City* by Fitter and Lousley, published in 1943 by the Corporation of London, in which the latter author also gives an historical account of the botany of the City and both acknowledge their debt to members of this Society. Lousley refers to two papers by him in the *Reports of the Botanical Exchange Club of the British Isles*, in which he records 23 species growing on bombed-sites in 1942 and 112 by 1944. He also draws attention to a hybrid *Senecio* which he named after the City—*Senecio* \times *londinensis*—as he described it from a bombed-site specimen. A former member, Dr. Audrey Henson, has placed a collection of bombed-site plants from the Shadwell district in the British Museum Herbarium, which,

together with the Holborn collection presented by the late James Whittaker and several City specimens deposited by Lousley, forms permanent record of a flora fast disappearing and, we hope, never to appear again. In the *Lond. Nat.* for 1953 a short sketch of the vegetation of Cranford Park is made by A. W. Westrup as the basis for a future survey of this public open space in S.W. Middlesex but no further details have been published. As with other counties, local Societies, e.g. at Hampstead, Ruislip and Harrow School, have not neglected their districts. R. M. Harley's *Flowers and Ferns of Harrow* replaces the earlier *Flora of Harrow* by J. C. Melvill in 1864 (re-edited in 1876 by W. M. Hind), all based on the work of Harrow boys. One of J. Ardagh's *Bibliographical Notes* in the *Journal of Botany*, 1928, is entitled *Ballard's Catalogue of Islington Plants* and presents a fascinating list of plants to be found in the first half of the nineteenth century in this London borough.

SYSTEMATIC STUDIES

Reference above to the two Middlesex plants written about by Kent brings me to consider one or two other species that have been written about by other observers. J. E. S. Dallas remarks in the *Lond. Nat.* for 1926 on the occurrence at Mickleham of the bird's-nest Orchid, *Neottia nidus-avis*; an anonymous pen in the *Lond. Nat.* for 1928 mentions a mediterranean birthwort, *Aristolochia rotunda*, appearing unexpectedly in Surrey; both species are rare. Herman Spooner, one of the few stalwarts still with us, asks in the *Lond. Nat.* for 1932 whether the fritillary, *Fritillaria meleagris*, once recorded from all London Area counties, still exists; it is, I think in three but very locally. Groups of plants have also inspired papers; some, like the willow-herbs (*Epilobium*) by R. W. Robbins in the *Lond. Nat.* for 1940 have been broadly treated but others have been specifically discussed from the London Area point of view. L. G. Payne, in the *Lond. Nat.* for 1933, indeed, looks beyond our horizon when describing *The Ferns of the Home Counties* but his remarks that eastern counties are not so suitable climatically as elsewhere, apply; of the 25 in Home Counties 17 occur in the London Area, from bracken in all our old 24 sub-divisions to the marsh buckler (*Thelypteris palustris*) in one. Ferns, again, provide Robbins with material for his note in the *Lond. Nat.* for 1925, *On the Occurrence of Certain Ferns in Surrey*—particularly wall species found under railway platforms. Another cryptogamic group is accounted for in the *Lond. Nat.* for 1949 by R. A. Boniface, *The Hepatics of the London Area*; our southern districts, especially the Blackheath beds, are richest but the drying-up of sphagnum bogs and atmospheric pollution has depleted our species on the whole. Of flowering plants, a small group, *The Violets of Limpsfield Common* is analysed by Robbins, who notes a possible hybrid between the wood- and dog-violet; and a large one, the genus *Rubus*, is described by W. Watson, the late specialist. He has a series for some years from 1928 on *The Brambles of Kent and Surrey*, followed in the *Lond. Nat.* for 1946 (in collaboration with C. Avery) by *The Brambles of Middlesex*. Details of character and distribution of the species are given for this thorny genus. The specialist is again in evidence in the *Lond. Nat.* for 1944, where Lousley works out for us *The Docks and Sorrels of the London Area*: he says it is a good area to study the genus *Rumex*, possessing 14 species; one, the purple-veined, *Rumex sanguineus*, was once recorded by Merrett in 1667 at Hampstead but appears to be extinct now. Collaboration between

the keen field-botanist and the herbarium worker has resulted in a trio of papers, mainly on alien species, of three genera: *Sisymbrium*, *Symphytum* and *Polygonum*. Mrs. B. Welch and myself, feeling that several alien species in the *Hand List* (see below) would be but names to several members, have keyed out and described first, in the *Lond. Nat.* for 1951, *The London Rocket and its Allies of the London Area*; secondly, in the *Lond. Nat.* for 1953, *The Comfrees of the London Area* and, thirdly, in the *Lond. Nat.* for 1954, *The Alien Polygonums of the London Area*. We hope that these guides of ours and of others will still assist and encourage the recording of our species.

RECORDING

The recording of our species has, indeed, been the most constant activity of the greatest number of our botanists. The collation and publication of records may have been in the hands of a few but these have invariably acknowledged their debt to the many. I have mentioned the early records based on fossil evidence and feel that I should not pass to modern times without reference to Castell's remark, in his Presidential Address, that the entry in 1665 in Pepys' Diary, noting the discovery of a nut tree and a yew tree covered with ivy in digging a dock at Blackwall "must be the first published record of the existence of *Corylus avellana*, *Taxus baccata* and *Hedera helix* in the post-glacial deposits of the Thames estuary". To step forward a couple of centuries we learn, as pointed out by Lousley, that it was agreed by our founder Society, the Haggerstone Entomological, that steps should be taken to establish an independent botanical society but no further developments are recorded; in fact, it is to our early members R. W. Robbins, L. J. Tremayne, F. J. Hanbury, C. S. Nicholson and Herman Spooner that we owe the foundation of our botanical work. Nicholson used to publish in the Annual Reports of the North London Natural History Society the interesting finds of the year and by 1913 was able to report 730 species and to credit P. H. Cooke with laying down the nucleus of our Herbarium. An important step was taken in 1915 when 12 subdivisions south of the Thames were set up to facilitate recording. In the following year the Recorder, Bishop, notes that about 350 species had been observed in one or more of the southern subdivisions and our *Transactions* give us the newly-devised 12 subdivisions for north of the Thames. From this time records flowed steadily in and, by 1924, 829 species were shown for the north and 917 for the south. Fitter, in an appendix to his *London's Natural History*, gives the 100 commonest species which he says had been noted in all of the 24 subdivisions. He extracts this information from the *Botanical Records of the London Area* published in eight supplementary parts of the *Lond. Nat.* from 1928 to 1936 under the joint editorship of Bishop, Robbins and Spooner. Based on members' records it does omit a few species but provides an excellent account of the flora of our area; nomenclature followed the 11th edition of *The London Catalogue*, 1925. During its annual appearance, Robbins also published noteworthy records such as *Potentilla palustris* new to South Essex and *Myosurus minimus* at Denham in Bucks., where T. G. Collett and myself unsuccessfully searched for it only this year.

Our present recorder for flowering plants, Lousley, took over in 1943, continuing Robbins' Annual Reports and undertaking to collate the latter's voluminous MS notes in preparation for a second edition of the *Botanical Records*. His appeal in the *Lond. Nat.* for 1944 for continued co-operation

from members was evidently not in vain for his papers on the new botanical finds of each year are delightfully informative; usually some matter of special or topical interest is introduced—bombed-site records beginning in the *Lond. Nat.* for 1943; shoddy-field aliens at Hextable and the curious conglomeration of alien species in the Brockham Hill bomb-crater in the *Lond. Nat.* for 1948; myxomatosis in the *Lond. Nat.* for 1955 and a visit to Buckingham Palace grounds in the *Lond. Nat.* for 1956. The effect of the weather on plants and botanists is invariably discussed. In 1946 another important step was taken when the 24 subdivisions were abandoned in favour of Watsonian vice-counties. Broadly speaking the system, inaugurated by H. C. Watson, and recognized by all botanists to-day, divides the larger counties into two or more vice-counties; this affects us only to the extent that we have portions of both North (v.c. 19) and South (v.c. 18) Essex in our area; our other counties (Surrey v.c. 17, Herts. v.c. 20, Middlesex v.c. 21 and Bucks. v.c. 24) are undivided except Kent of which only West Kent (v.c. 16) falls in the London Area. In a supplement to the *Lond. Nat.* for 1950 the first part of *A Hand List of Plants of the London Area* appeared under the editorship of Kent and Lousley; although owing much to the groundwork of its predecessor, it is essentially a new work, not only because it is topographically arranged by the vice-county system but because so much new recording is included—nearly 400 helpers contributed to cover the 1835 species listed; 12,000 individual records of less common species are only a fraction of the whole, say the editors. The nomenclature is brought up-to-date, following *The Flora of the British Isles* published in 1952 by Clapham, Tutin and Warburg and as far as possible new developments in the taxonomic field have been observed e.g. the segregates are recorded of aggregate species like *Rorippa nasturtium-aquaticum*, *Montia fontana* and *Aphanes arvensis*. A more detailed history of recording is given in the introduction than I have time for here. The seventh and last part came out in 1957 thus rounding off a notable achievement one year before our Centenary, an achievement of which the botanists are justly proud.

Finally, another recording scheme in which this Society played its part is the Distribution Maps Scheme launched in 1954 by the Botanical Society of the British Isles, whereby an Atlas of maps, showing the distribution in the British Isles of each species, is to be produced. Regional cards were issued to volunteers who recorded the presence of species in each of the 10 km. grid squares of the Ordnance Survey National Grid. About 30 such squares fall wholly or mainly within our area and we were asked to take on the responsibility for these; the Botany Section Committee organized and collated the work during the time I was privileged to be its Chairman. As many as 700 species were recorded in some squares and recently the Director of the Scheme expressed to me his great satisfaction with our efforts. I am confident that we earned his praise but must acknowledge gratefully the considerable work done by the Croydon Natural History Society, who dealt with squares in their district. Little publicity has been given to this undertaking of ours except in the annual reports of the Botany Section and on the B.B.C.'s programme *Naturalists' Notebook*, when I had the honour to represent the botanists of this Society.

Ladies and gentlemen, I have attempted in very short space to review and account for our wardenship of the plants of our area, conscious that much has been omitted, particularly much good work by the Nature

Conservation Committee. Our plants have been studied from the historical, topographical, systematic and floristic points of view as I hope to have shown. Many areas and many plants remain to become the subjects of future papers and I am sure that should some botanically minded President wish to review in one hundred years' time a second century of activity he will be able to say then as I say now "well done".

Nomenclature in the Address follows Dandy, 1958. *List of British Vascular Plants*.

Botanical Records for 1960

Compiled by J. EDWARD LOUSLEY

THE weather of 1960 will long be remembered by London botanists. In complete contrast to the glorious summer of the previous year, overcast skies and rain continued for a longer period than any in living memory. There were no really hot days, though a few in early May were pleasantly warm. From then onwards, too much rain, and too little warmth, retarded the development of flowers, though it was not until September that the ground became so saturated that flooding handicapped botanical work and raised the levels of ponds sufficiently to submerge the vegetation of their margins.

The number of records contributed in 1960 was about the same as in recent years though their distribution over our Area was less satisfactory. Well over half were from Surrey and there was a marked falling off in the number received for some of the less thoroughly worked counties. Particularly useful additions to our records are those from Prince's Coverts sent by Mrs. J. E. Smith, and from Croydon Airport from Dr. D. P. Young and the writer. It is gratifying to report that the forecast last year that the little grass *Nardurus maritimus* was likely to be found on the chalk within our Area (*Lond. Nat.*, 39, 37, 1960) was quickly justified by its discovery in the Chipstead Valley by Mr. and Mrs. Peter Hall. An assemblage of bird-seed aliens in Green Park just off Piccadilly found by Lady Anne Brewis was of exceptional interest in view of the locality.

An unsatisfactory feature of the year's work has been confusion and frustration due to deliberate planting of roots in wild situations. Of these, the least serious was *Gentiana acaulis*, which is almost certainly a garden plant, on chalk grassland above Buckland. The belated information that lady orchid, *Orchis purpurea*, and early spider orchid, *Ophrys sphegodes*, were planted some years ago near the places where they have recently been found in Surrey throws grave doubt on the value of these records. There is now no way of deciding whether the new plants have arrived naturally, are the offspring of the ones planted, or indeed are from these roots which have survived. Neither is the practice of planting out free from objection when it is put on record at the time. Two sundews, *Drosera rotundifolia* and *D. intermedia* were deliberately introduced into West Meadow Bog, Ken Wood, and with them cross-leaved heath, *Erica tetralix*, was accidentally planted. Every root removed from one habitat to another with soil must transfer vast numbers of the diaspores of other species—small seeds of flowering plants, spores of ferns and bryophytes, algae, and no doubt fungi and animals as well. Its introduction immediately renders valueless subsequent records of other species which could be concerned from the vicinity, and it makes serious phytogeographical studies impossible. The risk is increased greatly, when the transfer is made by people competent to select soils and habitats resembling those from which the plants are taken. If this practice continues, the value of much of our botanical work will be jeopardized and there is a risk that distribution studies of some animal groups will also be obscured.

The nomenclature used in this report is based on the *List of British Vascular Plants* (1958) prepared by J. E. Dandy, and for species in that list authors' names are omitted in order to save space. The numbers

following place names are those of the 10-kilometre squares of the National Grid (for a full explanation see *Lond. Nat.*, 37, 182, 1958).

V.-C. 16, WEST KENT.

The discovery by K. White of a plant of mezereon, *Daphne mezereum*, in natural woodland north-east of Otford (55) is the first we have had for this species in the London Area. A colour transparency shows that the flowers were paler than those of the form most commonly grown in gardens, and the finder assures us that although the plant is close to houses it is in a situation where it is very unlikely to have been planted. The possibility that the seed was bird-sown after a bird had fed on berries in a garden is one that applies to all new habitats for this rare species in the south of England. Mr. White also found stinking hellebore, *Helleborus foetidus*, north-east of Otford (55).

F. A. Swain in 1959 found purslane, *Portulaca oleracea*, as a garden weed at Petts Wood (46), and about 100 plants of night-flowering catchfly, *Silene noctiflora*, in stubble in a chalky field at Green Street Green near Orpington (46)—this appeared again in 1960. *Tillaea recurva* Hook. f. was reported in October by F. H. Jones from a pond at Sidcup (47). Here it is known to have been introduced with *Pontederia* purchased from a well known firm of nurserymen. As the same firm supplied aquatics for a pond at Southampton where the *Tillaea* grows, it seems likely that this is the source of the material found growing in various parts of the country, and a probable explanation of its occurrence at Greensted, v.-c. 18 as reported in the *Hand List* page 347. The usual list of very welcome records has been received from H. M. Pratt. This includes asparagus, *Asparagus officinalis*, from Stone Marshes (57) which is of interest in connection with the long history of records of this species from Gravesend and elsewhere in the Thames Marshes, fennel, *Foeniculum vulgare*, from near Dartford Heath (57), bird's-foot fenugreek, *Trifolium ornithopodioides*, from Stone House Playing Fields (57), and greater spearwort, *Ranunculus lingua*, from Danson Park Lake, Bexley Heath (47)—though Mr. Pratt tells us that this was previously found here in 1955 by the Kent Field Club. Although a little outside our Area, mention must also be made of navelwort, *Umbilicus rupestris*, for which R. Clarke found a second station in the village of Crockham Hill in April.

V.-C. 17, SURREY.

The discovery by Mr. and Mrs. Peter Hall of *Nardurus maritimus* in the Chipstead Valley, in a place which has been visited repeatedly by large numbers of botanists, is an outstanding example of the scope for finding new plants even on the best worked ground. This little grass flowers in May, and is easily confused with *Catapodium rigidum* with which it is often associated. Now that attention has been drawn to it the plant is being found in widely scattered places in southern England and there are likely to be others still to be found within our Area.

Early spider orchid, *Ophrys sphegodes*, was found in chalk scrub above Limpsfield (45) by B. S. Brookes and P. R. Norman in 1959, but it seems that the single plant is likely to be the progeny of a Kentish specimen planted at the same spot as an experiment by Dr. F. Rose in 1942 (see *Proc. B.S.B.I.*, 4, 170, 1961). It now appears that the lady orchid, *Orchis purpurea*, reported last year (*Lond. Nat.*, 39, 37-38, 1960) is likely to have had a similar origin. Kent is the poorer by the roots of two rare orchids,

and Surrey has gained two records which can only be a source of confusion. If either of these species arrived by natural means, or reappeared from dormant seeds, the records are still valueless in view of the uncertainty.

In May the handsome gentian, *Gentiana acaulis* L. sensu lato, was found by Miss B. M. C. Morgan and Miss C. Gurney in chalk grassland above Buckland (25). It grew with rock-rose, chalk milkwort, horseshoe vetch, and other characteristic chalk plants. Records of this species in Britain, some of them from very wild places, date back from 1805 onwards but it is very unlikely indeed to occur other than as a deliberate introduction. If the gentian was planted, the maidenhair fern, *Adiantum capillus-veneris*, found by D. C. Kelly on a railway bridge near Merstham (25) at least had the merit of sowing itself, even though the wind-carried spores were probably blown from a nursery. When I visited the place with Mr. and Mrs. Peter Hall we found over 50 plants, some of them very large. A single plant of the same species was found by Mrs. B. Welch on a garden wall at Richmond (17).

Mrs. J. E. Smith has contributed valuable lists of records from round Claygate. In Prince's Coverts (16), to which the public have only recently had access, she found primroses, *Primula vulgaris*, abundant. Primroses have become so rare in our Area that to find them in quantity anywhere except on railway banks is quite surprising, and their survival here is a tribute to the thoroughness with which unauthorized visitors were formerly discouraged. In the same woods Mrs. Smith also found early purple orchids, *Orchis mascula*, spotted orchids, *Dactylorhiza fuchsii*, tway-blades, *Listera ovata*, and butchers' broom, *Ruscus aculeatus*. She also reports lesser periwinkle, *Vinca minor*, from Old Claygate Lane, *Montia sibirica* by a stream off Arbroom Common, and black mustard, *Brassica nigra*, from Esher Mills and Esher Sewage Works (all 16). There are few bogs left in our Area and her additional record of star sedge, *Carex echinata*, from Oxshott Heath (16) is therefore especially welcome, while dyer's greenweed, *Genista tinctoria*, from Ockham (05) is new to us from that part of Surrey. Mrs. Smith also records cherry plum, *Prunus cerasifera*, a much overlooked early flowering species, from a hedge at Claygate (16), star of Bethlehem, *Ornithogalum umbellatum*, from Esher Common, Arbroom Common and West End Common (16), and, with Miss M. McCallum Webster, *Fumaria micrantha* from Esher Sewage Works (16).

From Selsdon Vale (36), R. Clarke reports a patch some six yards long, of hairy vetchling, *Lathyrus hirsutus*, evidently long established. This habitat on the chalk is particularly interesting in view of the famous one in the Halliloo Valley less than three miles away where this alien was formerly regarded as native. Mr. Clarke also found a good colony of sedge, *Carex strigosa*, under Tilburstow Hill (35), and a prickly yellow-flowered nightshade, *Solanum rostratum* Dunal, which was determined by D. P. Young, on a rubbish tip near Caterham (35). K. E. Bull reported several aliens—*Bunias orientalis* as plentiful in a car-park near Kenley Police Station (36), *Centaurea montana* L., as increasing in rough ground near Riddlesdown Station (36). New records for *Veronica filiformis* continue to come in—Mr. Bull found it near Riddlesdown Station (36) and near Upper Warlingham Station (35) and Mrs. L. M. P. Small near Park Downs (25).

The disuse of Croydon Airport for aviation purposes offered an

opportunity to investigate the flora of an area long closed to botanists, and Dr. D. P. Young obtained a permit for the purpose and invited me to join him on his second visit. On the western side of the Airport (26) he showed me *Potentilla recta* in abundance scattered over a considerable area of rough grassland. There was also a large patch of *Euphorbia uralensis*. The remaining ground (in 36) produced two broomrapes, *Orobanche elatior* and *O. minor*, crow garlic, *Allium vineale*, grass-leaved vetchling, *Lathyrus nissolia*, basil-thyme, *Acinos arvensis*, *Anchusa azurea* well established, and *Cephalaria tatarica* Schrad. growing in competition with coarse grasses. The lists compiled by Dr. Young will fill a lot of distribution gaps.

J. L. Gilbert sent a number of records from Ham area including *Rorippa austriaca* from Ham Gravel Pits (17). In 1956 he collected a large-flowered cranesbill from the Thames mud near Teddington Lock and this was recently determined by C. C. Townsend and R. D. Meikle at Kew as *Geranium platypetalum* Fisch. & Mey. This is the plant which Mrs. B. Welch found in the same place in 1944, and again in 1950 and reported as quite naturalized. It appears in the *Hand-List* as *G. ibericum* L., most of the British records of which should be corrected to *G. platypetalum*. *Atropa belladonna* is reported by the Rev. F. H. Amphlett Micklewright as attaining bush-like proportions in a garden at 228 South Norwood Hill—adding yet another link in the distribution on the high ground in this district. Two further determinations of specimens collected by R. C. Wingfield have been received—*Sisymbrium volgense* Bieb. determined by Dr. Young from Lower Morden where it was established on a tip in 1957 and 1958 (26), and *Rosa sherardi* determined by Dr. R. Melville from Banstead Downs (26) in 1958. Also in 1960 a specimen of *Axyris amaranthoides* L. was determined by R. D. Meikle on material collected by A. E. Ellis in 1947 at Woodcote Avenue, Wallington (26).

On Mitcham Common (26) I saw small-flowered cranesbill, *Geranium pusillum* in two places, a comfrey, *Symphytum orientale*, field pepperwort, *Lepidium campestre*, and American winter-cress, *Barbarea verna*, was abundant on the old gunsite. Violets have now become rare, whereas a few years ago they were so plentiful that in some places their flowers could be seen from a distance colouring the ground. The reason for this rapid decrease is uncertain but it is more likely to be explained by trampling than by the flowers being picked. Near White Hill, Godstone (35) D. E. Kimmins found a number of plants of corn crowfoot, *Ranunculus arvensis*, in a fallow field—this is a decreasing species with us. On a rubbish tip near Chiswick Bridge (27), Miss M. McCallum Webster found *Tagetes minuta* L., and on the towpath at Kew (17) C. C. Townsend collected *Phytolacca acinosa* Roxb.

V.-c. 18, SOUTH ESSEX.

The only record received for this part of our Area came from Mrs. L. M. P. Small. She reports about eight plants of ramsons, *Allium ursinum*, from Gilwell Lane (39), which is of interest in view of our old record for Chingford.

V.-c. 20, HERTS.

A rare willow-herb, *Epilobium lanceolatum*, is reported by Dr. J. G. Dony from railway banks at Elstree (19). In 1959 Miss W. F. Buckle found the much advertised shoo-fly plant, *Nicandra physalodes* on dis-

turbed ground at Garston (10), and *Ambrosia artemisiifolia* as a garden weed at Watford (19).

V.-C. 21, MIDDLESEX.

It is many years since we last had occasion to report plants from Piccadilly (28), and a group of bird-seed aliens growing just inside Green Park in October aroused considerable interest and was the subject of an article in *The Times* for November 3, and was noticed in later issues of other papers. These plants were first noticed by Lady Anne Brewis and were associated with hemp, *Cannabis sativa*, growing eight feet tall. They included *Guizotia abyssinica* Cass., *Centaurea diluta* Ait., flax, *Linum usitatissimum*, and three grasses—*Panicum miliaceum* L., *Phalaris canariensis*, and *Setaria viridis*. No doubt they originated from a packet of bird-seed mixture but one can only guess at how the seeds arrived at that spot.

Professor E. Warmington reports a fine plant of violet helleborine, *Epipactis purpurata* from Scratch Wood (29); D. H. Kent found tuberous pea, *Lathyrus tuberosus*, as a weed in a flower bed in Syon House grounds (17). Here he also found rustyback, *Ceterach officinarum*, as a single large plant growing out of a crevice of an obelisk, and another fern, *Polypodium vulgare*, he noticed as plentiful on an old wall at Heston (17). R. S. R. Fitter found many seedlings of Norway maple, *Acer platanoides*, in Holland House grounds (27), and D. E. Allen sent me a specimen of *Rumex tenuifolius* found in old turf on the east bank of the Serpentine, Kensington Gardens (28).

Mention has already been made of the planting of two species of sundew, *Drosera rotundifolia* and *D. intermedia* and with them a few plants of *Erica tetralix*, in West Meadow Bog, Ken Wood (28). All three species formerly grew at Hampstead and further details appear elsewhere (*Proc. B.S.B.I.*, 4, 198, 1961).

V.-C. 24, BUCKS.

The only record received for this vice-county is from Mrs. L. M. P. Small, who found strawberry clover, *Trifolium fragiferum*, west of Horton (07).

At the present time new county Floras are in preparation for all the counties of which parts fall within our Area, with the exception of Buckinghamshire. Kent is being compiled by Dr. F. Rose, Surrey by the Surrey Flora Committee (Secretary, Mrs. B. Welch), Essex by B. T. Ward and S. T. Jermyn, Hertfordshire by Dr. J. G. Dony, Middlesex by D. H. Kent. No doubt the very great differences between the numbers of records sent in for the various parts of our Area is accounted for, in part, by the fact that some members report their discoveries direct to the compilers of the county floras, and not to us.

Our own records are arranged under vice-counties to facilitate the work of compilers of local floras, who can cite them without the necessity of going through a lot of printed material with which they are not concerned. Their main purpose to the Society is to record the plants of our own Area, and especially those found by our members. Publication here has the advantage of being prompt and making records available for a dual purpose. It is hoped that members who report elsewhere will also let us have notes of the plants found within our Area and that an effort will be made to provide more information about the districts which appear at present to be neglected.

We are grateful to the following for their contributions during the year:—D. E. Allen, E. B. Bangerter, Lady Anne Brewis, Miss W. F. Buckle, Mrs. W. Bussey, K. E. Bull, R. Clarke, Dr. J. G. Dony, A. E. Ellis, R. S. R. Fitter, J. L. Gilbert, D. C. Kelly, D. H. Kent, D. E. Kimmins, D. McClintock, R. D. Meikle, Dr. R. Melville, Rev. F. H. Amphlett Micklewright, A. F. Mussellwhite, H. M. Pratt, Mrs. L. M. P. Small, Mrs. J. E. Smith, F. A. Swain, C. C. Townsend, Prof. E. Warmington, Miss M. McCallum Webster, Mrs. B. Welch, K. White, R. C. Wingfield, Dr. D. P. Young.

Petersham Common, Surrey

By B. WELCH

Notes on some changes seen since 1943, followed by a list of plants

THIS Common (National Grid 51/1873) is woodland on a clay slope facing westward to the alluvial meadows by the Thames, and thus differs from the others on the outskirts of Richmond Park.

By the "Richmond, Petersham and Ham Open Spaces Act 1902" Petersham Common and certain meadows and manorial rights in the same were vested in the Richmond Corporation for purposes of public enjoyment and placed under a Board of Conservators. Its amenity value is appreciated locally, but perhaps not its natural history interest. The major paths are well kept and a number of seats were provided (apparently long ago) by the Metropolitan Public Gardens Association.

Owing to neglect in the War years, much of the wood became a thicket. In 1953 some Oaks and Elms were felled to give a delightful glimpse of the River from the terrace at the western corner of the Star and Garter Home for Disabled Soldiers. In January 1954 a Scarlet Oak was planted by the Mayor of Richmond to commemorate the Coronation. (An English Oak had been chosen in 1937 to commemorate that of King George VI.) A group of Rhododendrons and some Daffodils were planted above Petersham Road. In 1955-56 much undergrowth was cleared at the southern end and, as the first stage of a five-year plan, felling of large trees began in the winter of 1957-58. This was continued in the two following winters, 38 trees falling in 1959-60. Some double-flowered Japanese cherries were planted.

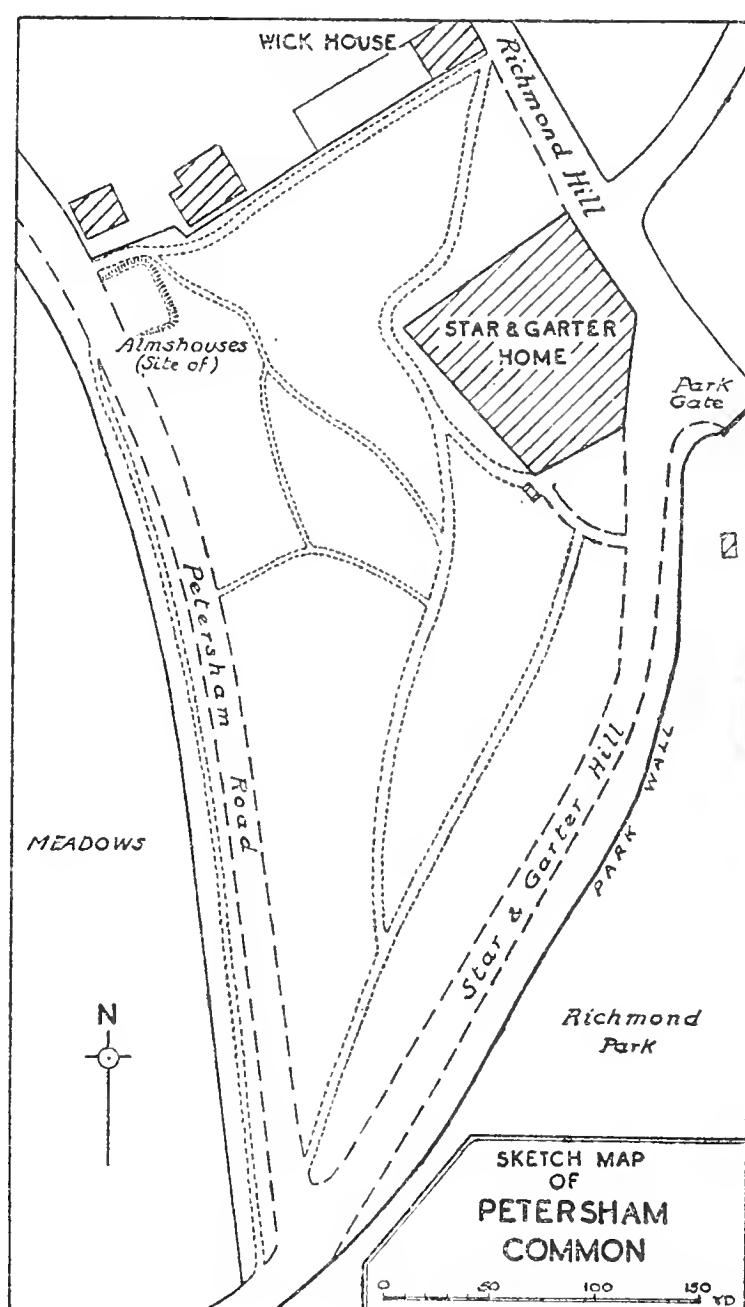
This policy of destruction and replacement by exotics was resented by certain local residents, but reports from the Richmond Society and correspondence in the local newspaper had no effect. Ultimately Mr. Castell looked into the matter on behalf of the L.N.H.S. and his summary of the situation is published in the *London Naturalist* for 1959, page 145. It is hoped that in future the Conservators will seek advice from naturalists, bearing in mind that the trees of the wood and the native plants, birds and small animals are of interest. The present position is that many old trees have been destroyed and much ground churned up and left bare, while areas disturbed in previous years have been invaded by cocksfoot grass, nettles, docks and other weeds.

The London Clay which underlies Richmond Park is at the surface on this slope which falls westward and southward from about 150 ft. near the Star and Garter Home (on the site of the famous hotel of the

same name) to about 25 ft. at the edge of the meadows. The clay tends to become waterlogged in winter, and is liable to slipping. At one place seepages form a black swamp. The roots of the large trees no doubt play an important part in stabilizing the steep slope. The walls of the Almshouses (built in 1867) cracked owing to slipping of the foundations and they were demolished in 1953; their site is now a lawn with seats.

The Common, known locally as Petersham Wood, now has an area of about 17 acres. There is a narrow belt of woodland between Star Hill, the old causeway or "causie", a rough steep lane, and the Park wall and another belt, mainly English elms, between the present Petersham Road (the main road between Richmond and Kingston), which was made in 1773, and the old road below it. The old road was unusable in winter, being little above river-level. On the eastern side of the present road, near the southern end of the Common, is an old pump, probably used to feed a horse trough.

The greater part of the area is woodland regenerating naturally in the absence of grazing; it is no doubt a relic of a longer stretch. Conditions are now very different inside Richmond Park, with grazing by deer and sheep (and some rabbits), but the clay hillside continues southward through Petersham Park and Pembroke Lodge grounds, where there is still



a bluebell wood south of the house. The slope between there and Petersham Common was formerly wooded. In the *Victoria County History, Surrey* Vol. 3, page 529 we read that in 1671 Petersham Park was "bounded on the east by the thick covert under the Mount called King Henry's Mount" which is north of Pembroke Lodge; and C. L. Collenette, in his *History of Richmond Park*, 1937, page 22, mentions that in 1834, when Petersham Park was thrown into Richmond Park and the Terrace Walk made from Richmond Gate to Pembroke Lodge, the thick trees which had impeded the view were removed.

The trees of Petersham Wood are of various ages. Some of the Oaks are said to be upwards of 200 years old and there are ancient Wych Elm, Field Maple and Ash trees. As mentioned in the *Flora of Surrey*, 1931, page 580 there is a specimen of Wych Elm in the British Museum (Natural History) which must have come from Petersham Wood. It is in Herb. Rand, labelled "Near Ld. Harrington's at Petersham on the left hand side going up the Hill". Lord Harrington (whose mansion in Petersham Park was demolished in 1834) was created an Earl in 1742. Isaac Rand, an apothecary, died in 1743.

The northern part was probably cleared of trees long ago or possibly when the Hotel was rebuilt in 1890, and between the Star and Garter Home and the northern tip is mainly a grassy slope with a few young trees and clumps of gorse. Below are several old Blackthorns and Hawthorns, some festooned with Traveller's Joy. Near the bottom are English Elms with a thicket of suckers. In mid-May this slope is a sea of white Cow-parsley. At this end is a patch of *Trachystemon orientalis* and, nearby, a fine plant of Virginia Creeper climbing over the bushes. The edge of the Almshouses site is marked by Winter Heliotrope, of which there is a large patch near the top of Star Hill and another below Petersham Road near the southern tip. Dogwood occurs at this northern end only, and the Wayfaring Trees were here. There seems to be no honeysuckle in the wood, no horsetail and no fern, not even Bracken. Many birds had their homes in the unkempt woodland and grey squirrels were numerous.

For many years the Common had been neglected and by 1943 a large stretch of the south-western part was a thicket of Holly and the ground carpeted with Ivy and Brambles. Some clearance was desirable and the increased light has favoured the Violets, Goldilocks and Wood Melick, all of which, luckily, escaped damage during the tree-felling, but docks are threatening to swamp the only patch of Greater Stitchwort. The Bluebells which escaped destruction should have a better chance of flowering. It is of interest that much of the Lesser Celandine is the woodland form which spreads by bulbils which fall from the axils of the leaves, and which has few flowers and rarely any fruit. Four species seem to have become extinct since 1943; Wayfaring Tree, Wild Strawberry, Wood Sage and Wood Poa; the last three perhaps victims of competition with stronger species. Seedlings and small trees of Oak, Ash, Field Maple, Sycamore and Holly are plentiful.

In the following list the nomenclature and order is that of J. E. Dandy's *List of British Vascular Plants*, 1958. Well-established aliens are included but casual weeds omitted.

Taxus baccata L. Yew. One 4 ft. 6 ins. and one 6 ins. tall, west of Star and Garter Home.

- Clematis vitalba* L. Traveller's Joy. Frequent in northern part, often climbing high in the trees.
- Ranunculus repens* L. Creeping Buttercup. One big patch in southern part.
- R. auricomus* L. Goldilocks. Six scattered patches.
- R. ficaria* L. Lesser Celandine. Abundant; two forms occur, one with bulbils, long leaf stalks and few flowers, is frequent in the southern half, the other is much more floriferous and sets fruit, but has no bulbils.
- Cardamine pratensis* L. Lady's Smock. Scarce.
- Alliaria petiolata* (Bieb.) Cavara & Grande. Garlic Mustard. Occurs in north-west corner.
- Viola odorata* L. Sweet Violet. One patch, by Star Hill, known since 1947.
- V. riviniana* Reichb. Dark Wood Violet. Three patches.
- Stellaria holostea* L. Greater Stitchwort. One patch in angle of paths near southern end (known since 1943).
- Moehringia trinervia* (L.) Clairv. Three-nerved Sandwort. Rare; near southern end and between road and Park wall.
- Geranium robertianum* L. Herb Robert. Only near southern end.
- Acer pseudoplatanus* L. Sycamore. Not frequent but increasing.
- A. campestre* L. Field Maple. A number of ancient trees, mainly in the southern half; younger trees and seedlings occur.
- Ilex aquifolium* L. Holly. Well dispersed but poorly grown. Seedlings frequent. In the former thickets very few hollies seemed to flower, and now only one berries well.
- Parthenocissus quinquefolia* (L.) Planch. Virginia Creeper. One plant near fence of Wick House garden.
- Ulex europaeus* L. Gorse. Three old clumps north of the Star and Garter Home.
- Rubus fruticosus* agg. Bramble. Frequent as a non-flowering carpet in the lower part of the wood.
- R. acutipetalus* L. & M. recorded for Petersham Common by W. C. R. Watson in *Hand List of Plants of the London Area* page 85.
- R. idaeus* L. Raspberry. One patch between road and Park wall.
- Fragaria vesca* L. Wild Strawberry. Only by Park wall about halfway down Star Hill, 1945-50.
- Geum urbanum* L. Wood Avens. Widespread and abundant.
- Rosa canina* agg. Wild Rose. A few weak scattered plants.
- Prunus spinosa* L. Sloe. A thicket near the north end includes some very old bushes; also between road and Park wall.
- P. domestica* L. subsp. *insititia* (L.) C. K. Schneid. Was reported by W. A. Todd (*Surrey Flora*, 1931, page 257). Just above the Petersham Road, in the northern half, are two different "wild plums", neither seen with fruit. One has spines and quite large leaves, and suckers widely; the other has narrower leaves and flowers slightly later.
- P. avium* (L.) L. Wild Cherry. Several fine old trees, with suckers also flowering, in lower part of wood.
- Crataegus monogyna* Jacq. Hawthorn. Well distributed; mostly tall scraggy bushes, some old. Much reduced in number recently.
- Sorbus aucuparia* L. Mountain Ash or Rowan. One small tree south of centre; probably bird-sown.
- Malus sylvestris* Mill. subsp. *mitis* (Wallr.) Mansf. Apple. Several trees above Petersham Road towards north end; some old and dying.

- Ribes uva-crispa* L. Gooseberry. One small bush on west side of Star Hill 1946-59; another near Park wall 1956.
- Epilobium hirsutum* L. Great Hairy Willow-herb. One towards south end; another near Park wall, 1956.
- E. montanum* L. Broad-leaved Willow-herb. On Park wall, 1956.
- E. adenocaulon* Hausskn. American Willow-herb. A well-established patch near junction of paths in southern part; also below Star and Garter Home.
- E. obscurum* Schreb. Short-fruited Willow-herb. On ledge of Park wall, 1956.
- Chamaenerion angustifolium* (L.) Scop. Rosebay Willow-herb. Three patches above Petersham Road; increasing since tree-felling.
- Circaea lutetiana* L. Enchanter's Nightshade. Widespread and abundant.
- Thelycrania sanguinea* (L.) Fourr. Dogwood. North and west of Star and Garter Home.
- Hedera helix* L. Ivy. Forms a carpet over much of the ground on both sides of Star Hill and in central area; very little climbing up trees.
- Anthriscus sylvestris* (L.) Hoffm. Cow Parsley. Abundant in northern quarter.
- Rumex obtusifolius* L. Broad-leaved Dock. Increasing in areas disturbed by tree-felling.
- R. sanguineus* L. var. *viridis* Wood Dock. Occasional.
- R. conglomeratus* Murr. Sharp Dock. Between road and Park wall.
- Humulus lupulus* L. Hop. One plant climbing over Hawthorn near west side of Star and Garter Home.
- Ulmus glabra* Huds. Wych Elm. A number of fine old trees, particularly in the middle of the wood, and by Star Hill, from which came the specimen in Herb. Rand in the British Museum, collected before 1743.
- U. procera* Salisb. English Elm. Abundant and suckering freely below the Petersham Road and, at the north end, above it; no doubt planted.
- Betula pendula* Roth. Silver Birch. A few around the Star and Garter Home, and elsewhere. Planted.
- B. pubescens* Ehrh. Common Birch. Some near west corner of Star and Garter Home. Planted.
- Carpinus betulus* L. Hornbeam. One by Star Hill, but mainly on lower slope near centre; not old trees; perhaps planted.
- Corylus avellana* L. Hazel. A few west of Star and Garter Home.
- Fagus sylvatica* L. Beech. A few young planted trees and an old one above Petersham road.
- Quercus robur* L. Common Oak. Many trees of all ages including some very ancient ones, some stag-headed, a number of which have been felled. Plenty of seedlings occur.
- Salix caprea* L. Goat Willow. One only near Park wall.
- Fraxinus excelsior* L. Ash. Four trees (one very old) near west corner and south of Star and Garter Home; some at south end of wood. Seedlings frequent and widespread.
- Trachystemon orientalis* (L.) G. Don. An introduction from the Eastern Mediterranean area, flowering in March and April. Near the fence of Wick House garden, a patch about two yards square in 1947 has now increased to about four yards square.
- Solanum dulcamara* L. Woody Nightshade. One plant by path, near southern end 1943-59.

- Digitalis purpurea* L. Foxglove. Two in hollow west of Star and Garter Home in 1943; several nearby in 1959.
- Veronica montana* L. Wood Speedwell. Both sides of path to gate to bungalow near top of Star Hill and against Park wall nearby, 1945-59; especially abundant and flowering well in 1950; perhaps planted.
- V. chamaedrys* L. Germander Speedwell. Scarce, two patches.
- Stachys sylvatica* L. Hedge Woundwort. Occasional.
- Ballota nigra* L. Black Horehound. Only near Star and Garter Home.
- Glechoma hederacea* L. Ground Ivy. Four patches, widely scattered.
- Teucrium scorodonia* L. Wood Sage. One patch west of Star and Garter Home, 1943-49.
- Ajuga reptans* L. Bugle. By path to gate to bungalow near top of Star Hill in 1945 only; perhaps planted.
- Sambucus nigra* L. Elder. Few, scattered and small.
- Viburnum lantana* L. Wayfaring Tree. Recorded as unusual on London Clay by W. A. Todd, *Surrey Flora*, 1931, p. 358. There was a large bush which flowered well by the Petersham Road just south of the Almshouses. This disappeared in 1946. A smaller bush, in the wood above, was broken down in 1959, and though not dead, was cleared away.
- V. opulus* L. Guelder-rose. One between road and Park wall.
- Tussilago farfara* L. Coltsfoot. Scarce, two areas only.
- Petasites fragrans* (Vill.) C. Presl. Winter Heliotrope. Four patches, increasing in size; flowering between Christmas and end of February, depending on weather.
- Endymion non-scriptus* (L.) Garcke. Bluebell. Scattered through wood from middle southwards; generally poor flowers.
- Tamus communis* L. Black Bryony. One by path near southern end 1943-59.
- Arum maculatum* L. Cuckoo-pint. Abundant near Park wall and on lower part of slope.
- Carex sylvatica* Huds. Wood Sedge. About eight plants in three groups near centre 1943-59 and one near Park wall at southern end in 1945.
- C. divulsa* Stokes. Four scattered clumps.
- Festuca gigantea* (L.) Vill. Tall Brome. Abundant except in northern quarter.
- Poa nemoralis* L. Wood Poa. One patch west of Star and Garter Home, 1943-44.
- Dactylis glomerata* L. Cocksfoot. Above Petersham Road, increasing.
- Melica uniflora* Retz. Wood Melick. One patch above Petersham Road, west of south corner of Star and Garter Home; has increased since 1943. Not known elsewhere in the neighbourhood.
- Bromus ramosus* Huds. Hairy Brome. Rare; only between lower part of Star Hill and the Park wall.
- Brachypodium sylvaticum* (Huds.) Beauv. Slender False-brome. Locally dominant in central and southern areas.
- Hordeum secalinum* Schreb. Meadow Barley. Grassy bank north of Star and Garter Home, 1944. Perhaps introduced.
- Arrhenatherum elatius* (L.) Beauv. ex J. & C. Presl. Oat-grass. Occasional.
- Holcus lanatus* L. Yorkshire Fog. Above Petersham Road, scarce.
- H. mollis* L. Creeping Soft-grass. Above Petersham Road, scarce.
- Agrostis gigantea* Roth. Black Bent. One patch near southern end, 1959.
- Alopecurus pratensis* L. Foxtail. At southern end and on bank north of Star and Garter Home.

A Contribution to the Flora of Central London

ADDENDA

OWING to an unfortunate oversight the Families *Crassulaceae* to *Compositae* were omitted from the Appendix to my paper (*Lond. Nat.*, 39, 61, 1960). The following should be added to the list of plants recorded from bombed sites in Central London but unreported from other habitats there since 1939.

†*Sedum spurium*, †*Ribes sylvestre*, **Scandix pecten-veneris*, *†*Coriandrum sativum*, *†*Petroselinum crispum*, *Pastinaca sativa*, *†*Anethum graveolens*, †*Polygonum sachalinense*, *†*Fagopyrum esculentum*, †*Rumex palustris*, *Betula pubescens*, *Corylus avellana*, *Populus alba*, *P. nigra*, *Salix alba*, *S. fragilis*, *S. viminalis*, *S. caprea*, **S. viminalis*, *S. cinerea* subsp. *atrocinerea*, *†*Armeria maritima*, **Primula veris*, **Lysimachia nummularia*, *Cynoglossum officinale*, *†*Borago officinalis*, **Lycopsis arvensis*, **Lithospermum arvense*, *Echium vulgare*, *Verbascum nigrum*, †*Antirrhinum majus*, †*Linaria purpurea*, †*Cymbalaria muralis*, *Scrophularia nodosa*, *Digitalis purpurea*, **Odontites verna* subsp. *serotina*, *Verbena officinalis*, *Origanum vulgare*, *Glechoma hederacea*, †*Centranthus ruber*, *Knautia arvensis*, †*Helianthus annuus*, †*H. decapetalus*, †*Cosmos bipinnatus*, *†*Tagetes patula*, †*Gaillardia aristata*, *Inula conyza*, *Erigeron acer*, †*Anthemis tinctoria*, *A. cotula*, †*Chrysanthemum maximum*, *C. vulgare*, †*C. indicum*, †*Onopordum acanthium*, *Centaurea scabiosa*, *Cichorium intybus*, *Leontodon hispidus*, *Picris echioides*, *†*Lactuca sativa*, *Hieracium lachenalii*, *H. perpropinquum* and *H. pilosella*.

D. H. KENT.

The Flora of Middlesex Walls

By DOUGLAS H. KENT

THE occurrence of plants on walls has long been known—Turner (1548) records that “Hartes tongue [*Phyllitis scolopendrium*] groweth in welles and old walles”, and Gerard (1597), writing on “*Eruca sylvestris*” (*Diplotaxis tenuifolia*) states “most bricke and stone wals about London and elsewhere, covered with it”. He records also “*Paronychia rutaceo folio*” (*Saxifraga tridactylites*) and “*Paronychia vulgaris*” [*Erophila* sp.] . . . plentifully upon the bricke wall in Chauncerie [Chancery] lane, belonging to the Earl of Southampton”. Both these attractive species have, alas, long since been eradicated from Middlesex, in the immediate vicinity of the Metropolis.

A survey of the pertinent botanical literature has shown that numerous papers have been written on the flora of walls in various European countries, particularly Italy. These papers date from the late nineteenth century to the present time—a particularly good example being that of Anzalone (1951), in which 385 different plants are noted from the walls of Rome.

In Britain, however, although West (1911) gives some data for Ireland and Ridley (1930) information on English wall plants, the scientific study of the vegetation of walls is virtually a modern innovation, the pioneer work being that of Rishbeth (1948) on the walls of Cambridge, where 186 different species of phanerogams and vascular cryptogams were noted. Recently, an account of the flora of the walls of the City of Durham, where 168 different species of phanerogams and vascular cryptogams were recorded, was given by Woodell and Rossiter (1959).

The observations contained in this paper were made during a survey of the flora of 500 walls, or series of walls, in Middlesex (vice-county 21), during the four years 1957-1960. The walls studied, all of which had plants growing on them, included those enclosing gardens, parks, private estates and cemeteries. Stone and brick bridges and buildings were also included. These walls were, where possible, visited at least twice at different times of the year during the survey, though it was a common experience on a second visit to find that a particularly productive old wall had been repointed or rebuilt.

River walls were included both in the Cambridge and Durham surveys, but are excluded from the present study as they support many aquatic and semi-aquatic species largely introduced and distributed by seasonal flooding and tidal influence; Guppy (1893) gives information on this subject. Likewise it was found that churchyard walls tended to possess a specialized flora, some of the species commonly occurring in churchyards in different parishes being absent from other types of walls in the same areas. It was decided, therefore, to exclude these walls also, but it is hoped that both they and river walls may become the subjects of further papers at a later date.

Flowering plants and vascular cryptogams only were studied. In Table 1 are listed the different species found growing on Middlesex walls. The inclusion of a plant in the list does not indicate that it was present throughout the period of the survey; in fact many annuals occur as mere casuals, and prolonged dry spells can prove fatal not only to these but

also to some perennials. The nomenclature used in the list is based on that of Dandy (1958).

Some information on bryophytes is provided by Richards (1928).

THE FLORA

Table 1

LIST OF MIDDLESEX WALL PLANTS

The following list is arranged in order of the frequency of occurrence, the figure following each species indicating the number of walls (out of a total of 500) on which it has been recorded. Plants which are not native in the county are marked with a dagger.

<i>Poa annua</i> L. 240	<i>Achillea millefolium</i> L. 16
<i>Dryopteris filix-mas</i> (L.) Schott. 174	<i>Agrostis stolonifera</i> L. 14
† <i>Senecio squalidus</i> L. 125	<i>Agropyron repens</i> (L.) Beauv. 13
<i>Chamaenerion angustifolium</i> (L.) Scop. 122	<i>Convolvulus arvensis</i> L. 13
† <i>Cymbalaria muralis</i> Gaertn., Mey. & Scherb. 118	<i>Fraxinus excelsior</i> L. 13
<i>Sonchus oleraceus</i> L. 93	<i>Plantago major</i> L. 12
<i>Sagina procumbens</i> L. 87	<i>Arenaria serpyllifolia</i> L. 11
<i>Pteridium aquilinum</i> (L.) Kuhn. 64	<i>Bromus sterilis</i> L. 11
<i>Taraxacum officinale</i> Weber. 63	<i>Capsella bursa-pastoris</i> (L.) Medic. 11
<i>Senecio vulgaris</i> L. 46	<i>Parietaria diffusa</i> Mert. & Koch. 11
† <i>Conyza canadensis</i> (L.) Cronq. 43	<i>Asplenium ruta-muraria</i> L. 9
<i>Epilobium montanum</i> L. 42	<i>Hedera helix</i> L. 9
<i>Lamium album</i> L. 41	<i>Lamium purpureum</i> L. 9
† <i>Acer pseudo-platanus</i> L. 40	<i>Sisymbrium officinale</i> (L.) Scop. 9
† <i>Antirrhinum majus</i> L. 35	<i>Verbascum thapsus</i> L. 9
† <i>Buddleja davidii</i> Franch. 35	<i>Arrhenatherum elatius</i> (L.) Beauv. ex J. & C. Presl. 8
<i>Betula pendula</i> Roth. 33	† <i>Aster lanceolatus</i> Willd. 8
<i>Solanum dulcamara</i> L. 33	† <i>Chelidonium majus</i> L. 8
<i>Poa angustifolia</i> L. 32	<i>Cirsium arvense</i> (L.) Scop. 8
<i>Sambucus nigra</i> L. 28	† <i>Corydalis lutea</i> (L.) DC. 8
<i>Poa pratensis</i> L. 27	<i>Holcus lanatus</i> L. 8
<i>Sedum acre</i> L. 24	<i>Hordeum murinum</i> L. 8
† <i>Solidago altissima</i> L. 23	<i>Hypochoeris radicata</i> L. 8
† <i>Epilobium adenocaulon</i> Hausskn. 21	<i>Rubus fruticosus</i> L. agg. 8
<i>Phyllitis scolopendrium</i> (L.) Newm. 21	<i>Cerastium holosteoides</i> Fr. 7
<i>Urtica dioica</i> L. 20	<i>Chrysanthemum parthenium</i> (L.) Bernh. 7
<i>Artemisia vulgaris</i> L. 19	<i>Plantago lanceolata</i> L. 7
<i>Stellaria media</i> (L.) Vill. 18	<i>Rubus idaeus</i> L. 7
	<i>Betula pubescens</i> Ehrh. 6

- †*Cheiranthus cheiri* L. 6
Circaea lutetiana L. 6
Dactylis glomerata L. 6
Epilobium hirsutum L. 6
Polygonum persicaria L. 6
Rumex acetosella L. 6
R. obtusifolius L. 6
Tussilago farfara L. 6
Veronica arvensis L. 6
Calystegia sepium (L.) R.Br. 5
Chenopodium album L. 5
Lolium perenne L. 5
Lycopus europaeus L. 5
Solanum nigrum L. 5
Asplenium trichomanes L. 4
Ballota nigra L. 4
Crataegus monogyna Jacq. 4
Euphorbia peplus L. 4
Hieracium pilosella L. 4
Medicago lupulina L. 4
 †*Oxalis corymbosa* DC. 4
Poa compressa L. 4
Sonchus arvensis L. 4
Taxus baccata L. 4
Cerastium glomeratum Thuill. 3
Crepis capillaris (L.) Wallr. 3
 †*Diplotaxis muralis* (L.) DC. 3
 †*Laburnum anagyroides* Medic. 3
 †*Lapsana communis* L. 3
 †*Linaria purpurea* (L.) Mill. 3
Rorippa islandica (Oeder) Borbas
 3
Salix caprea L. 3
Trifolium dubium Sibth. 3
Veronica hederifolia L. 3
Vulpia myuros (L.) C.C. Gmel.
 3
 †*Aegopodium podagraria* L. 2
Alnus glutinosa (L.) Gaertn. 2
 †*Anemone × hybrida* Paxton. 2
Angelica sylvestris L. 2
Arabidopsis thaliana (L.) Heynh.
 2
 †*Aster novae-angliae* L. 2
 †*A. novi-belgii* L. 2
 †*Centranthus ruber* (L.) DC. 2
- †*Chamaecyparis lawsoniana*
 (Murr.) Parl. 2
 †*Crepis vesicaria* subsp. *taraxici-*
 folia (Thuill.) Thell. 2
Digitalis purpurea L. 2
Epilobium adnatum Griseb. 2
Fagus sylvatica L. 2
Festuca rubra L. 2
Galium aparine L. 2
Geum urbanum L. 2
 †*Helxine soleirolii* Req. 2
 †*Hieracium vagum* Jord. 2
 †*Ligustrum ovalifolium* Hausskn. 2
Mycelis muralis (L.) Dumort. 2
Myosotis ramosissima Rochel. 2
Polypodium vulgare L. 2
Reseda luteola L. 2
Rosa canina L. 2
Sagina apetala Ard. 2
Senecio viscosus L. 2
Sorbus aucuparia L. 2
Vulpia bromoides (L.) Gray. 2
Agrostis tenuis Sibth. 1
 †*Ailanthus altissima* (Mill.)
 Swingle. 1
 †*Althaea rosea* L. 1
Anthoxanthum odoratum L. 1
 †*Asparagus officinalis* L. 1
Atriplex hastata L. 1
 †*Avena sativa* L. 1
 †*Calystegia silvatica* (Kit.)
 Griseb. 1
 †*Campanula portenschlagiana*
 Roem. & Schult. 1
Carex remota L. 1
C. spicata L. 1
Catapodium rigidum (L.) C. E.
 Hubbard. 1
Centaurea nigra L. 1
Ceterach officinarum (L.) DC. 1
Chaenorhinum minus (L.) Lange.
 1
Chrysanthemum leucanthemum
 L. 1
Cirsium vulgare (Savi) Ten. 1
Clematis vitalba L. 1

- †*Cotoneaster horizontalis*
Decaisne. 1
- †*Descurainaea sophia* (L.) Webb
ex Prantl. 1
- Epilobium obscurum* Schreb. 1
- E. parviflorum* Schreb. 1
- E. roseum* Schreb. 1
- Erysimum cheiranthoides* L. 1
- †*Ficus carica* L. 1
- Fragaria vesca* L. 1
- Galium verum* L. 1
- Hieracium perpropinquum* (Zahn)
Druce. 1
- H. salticola* (Sudre) Sell & West.
1
- †*H. vulgatum* Fr. 1
- H. strumosum* (W. R. Linton)
A. Ley. 1
- Humulus lupulus* L. 1
- Hypericum perforatum* L. 1
- Ilex aquifolium* L. 1
- Lamium amplexicaule* L. 1
- †*L. maculatum* L. 1
- †*Larix decidua* Mill. 1
- Linaria vulgaris* (L.) Mill. 1
- †*Lobularia maritima* (L.) Desv. 1
- Lotus corniculatus* L. 1
- Matricaria recutita* L. 1
- †*Mentha spicata* L. 1
- †*Mercurialis annua* L. 1
- †*Montia sibirica* (L.) Howell. 1
- Myosotis discolor* Pers. 1
- †*Oxalis corniculata* L. 1
- Poa nemoralis* L. 1
- P. trivialis* L. 1
- †*Polygonum cuspidatum* Sieb. &
Zucc. 1
- Potentilla sterilis* (L.) Garcke. 1
- Prunella vulgaris* L. 1
- †*Prunus cf. cerasus* L. 1
- P. spinosa* L. 1
- Quercus robur* L. 1
- †*Ribes grossularia* L. 1
- †*R. sylvestre* (Lam.) Mert. &
Koch. 1
- †*Robinia pseudacacia* L. 1
- Rorippa sylvestris* (L.) Bess. 1
- Rosa dumetorum* Thuill. 1
- †*Rubus laciniatus* Willd. 1
- †*R. phoenicolasius* Maxim. 1
- †*R. procerus* P. J. Muell. 1
- R. ulmifolius* Schott. f. 1
- Rumex acetosa* L. 1
- R. conglomeratus* Murr. 1
- Sagina ciliata* Fr. 1
- Saxifraga granulata* L. 1
- S. tridactylites* L. 1
- Scrophularia nodosa* L. 1
- †*Sedum dasyphyllum* L. 1
- †*S. reflexum* L. 1
- Senecio aquaticus* Hill. 1
- S. jacobaea* L. 1
- †*Sisymbrium orientale* L. 1
- Sonchus asper* (L.) Hill. 1
- Stachys sylvatica* L. 1
- †*Symphoricarpos rivularis* Suksd.
1
- Taraxacum laevigatum* (Willd.)
DC. 1
- Thymus pulegioides* L. 1
- Torilis japonica* (Houtt.) DC. 1
- Trisetum flavescens* (L.) Beauv. 1
- Ulmus glabra* Huds. 1
- Urtica urens* L. 1
- Valerianella locusta* (L.) Betsche.
1

USUAL HABITATS OF WALL PLANTS

Two hundred and four different species were noted growing on walls in Middlesex, and as only 13 of them are plants usually confined to mural habitats in this county, it seems probable that the remaining 191 originated from other sources. The usual habitats, or origin, of the 204 species are shown in Table 2.

Table 2
USUAL HABITATS OF MIDDLESEX WALL PLANTS

<i>Habitat/s</i>	<i>No. of species occurring in this habitat</i>	<i>% of total number of species found on walls</i>
Waysides and waste places	88	43.2
Parks and gardens (plants of cul- tivated origin)	40	19.6
Meadows and grassy places	16	7.8
Hedges and banks	15	7.4
Walls	13	6.4
Woods and shady places	9	4.4
Close turf	8	3.9
Cultivated ground	7	3.4
Streamsides and damp places	7	3.4
Heaths	1	.5
Total	<hr/> 204	<hr/> 100

In a built-up county like Middlesex it is only to be expected that a large number (over 65%) of the plants found on walls originate from cultivated and waste ground, waysides and parks. Species of woodlands, streamsides and heaths are poorly represented, providing just over 8% of the total.

Plants which are virtually confined to walls in the county are *Phyllitis scolopendrium*, *Asplenium trichomanes*, *A. ruta-muraria*, *Ceterach officinarum*, *Polypodium vulgare*, *Corydalis lutea*, *Cheiranthus cheiri*, *Sagina apetala*, *Saxifraga tridactylites*, *Sedum dasyphyllum*, *Parietaria diffusa*, *Cymbalaria muralis* and *Centranthus ruber*. *Phyllitis scolopendrium* formerly grew on hedgebanks and in chalkpits, and *Polypodium vulgare* on hedgebanks and old tree stumps; both plants have now been virtually eradicated from these habitats. *Parietaria diffusa* frequently roots in soil at the base of walls or on adjacent rubble, but is always confined to their immediate vicinity.

Species which grow equally well on walls as in other habitats are *Pteridium aquilinum*, *Dryopteris filix-mas*, *Diplotaxis muralis*, *Sagina procumbens*, *Arenaria serpyllifolia*, *Sedum acre*, *Epilobium montanum*, *E. adenocaulon*, *Chamaenerion angustifolium*, *Buddleja davidii*, *Antirrhinum majus*, *Linaria purpurea*, *Veronica arvensis*, *Senecio squalidus*, *Conyza canadensis*, *Mycelis muralis*, *Vulpia myuros*, *Poa annua*, *P. compressa*, *P. pratensis* and *P. angustifolia*.

COMPARISON WITH WALL FLORAS OF OTHER AREAS

Comparison of the species found on Middlesex walls with an unpublished list compiled by the author from other parts of the London Area, a list from Cambridge (Rishbeth, 1948) and a list from Durham (Woodell & Rossiter, 1959) reveals a marked similarity of floral pattern.

The list made in the London Area consisted of plants found on 72 walls (16 in West Kent, 32 in Surrey, 22 in Herts and 2 in Bucks). Eighty-three different species were recorded, and of these, 75, or 90.4% had been noted in Middlesex. The eight species not found in Middlesex were *Rorippa amphibia*, *Diplotaxis tenuifolia* (common on walls in parts

of north Kent), *Trifolium micranthum*, *Sedum album*, *Veronica polita*, *Poterium sanguisorba*, *Ligustrum vulgare* and *Origanum vulgare*. The last three plants were recorded on the brickwork of an old railway bridge in a calcareous district of West Kent.

Rishbeth (1948) records 186 species from Cambridge, and of these, 117, or 62.9%, have been noted in Middlesex. Woodell and Rossiter (1959) give 168 species for Durham; of these, 106, or 63.1% have been found in Middlesex. The comparative figures would have been even higher if river and churchyard walls had been included in the present survey.

Table 3 gives details of the frequency of occurrence of the 20 most common Middlesex wall plants, with comparative data on the same plants in other parts of the London Area, and for some of them in Cambridge and Durham.

Table 3

				500 MIDDLESEX WALLS		72 LONDON AREA WALLS		186 CAMBRIDGE WALLS		168 DURHAM WALLS	
					% occur- rence		% occur- rence		% occur- rence		% occur- rence
<i>Poa annua</i>	...	...	...	240	48	27	37.5	83	44.6	26	15.5
<i>Dryopteris filix-mas</i>	...	...	...	174	34.8	20	27.8				
<i>Senecio squalidus</i>	...	...	...	125	25	16	22.2				
<i>Chamaenerion angustifolium</i>	...	...	...	122	24.4	8	11.1	24	14.5	35	20.8
<i>Cymbalaria muralis</i>	...	...	...	118	23.6	5	6.9	46	24.7		
<i>Sonchus oleraceus</i>	...	...	...	93	18.6	9	12.5				
<i>Sagina procumbens</i>	...	...	...	87	17.4	7	9.7				
<i>Pteridium aquilinum</i>	...	...	...	64	12.8	5	6.9				
<i>Taraxacum officinale</i>	...	...	...	63	12.6	8	11.1	54	29	42	25
<i>Senecio vulgaris</i>	...	...	...	46	9.2	10	13.9	30	16.1	18	10.7
<i>Conyza canadensis</i>	...	...	...	43	8.6	11	15.3				
<i>Epilobium montanum</i>	...	...	...	42	8.4	12	16.7			25	14.9
<i>Lamium album</i>	...	...	...	41	8.2	5	6.9				
<i>Acer pseudoplatanus</i>	...	...	...	40	8	3	4.2	25	13.4	23	13.7
<i>Antirrhinum majus</i>	...	...	...	35	7	4	5.3	47	25.3		
<i>Buddleja davidii</i>	...	...	...	35	7	3	4.2				
<i>Betula pendula</i>	...	...	...	33	6.6	1	1.4				
<i>Solanum dulcamara</i>	...	...	...	33	6.6	7	9.7				
<i>Poa angustifolia</i>	...	...	...	32	6.4	7	9.7				
<i>Sambucus nigra</i>	...	...	...	28	5.6	1	1.4	32	17.2	27	19.6

An examination of Table 3 reveals a few interesting points. It will be noted that *Poa annua*, *Dryopteris filix-mas* and *Senecio squalidus*, the three most frequent Middlesex wall plants, are also the three most frequent in other parts of the London Area. *Poa annua* is also the most frequent species of Cambridge walls, but curiously drops to fifth place in the Durham list. *Cymbalaria muralis* occurs at nearly the same frequency in Middlesex and Cambridge, but is apparently much less common elsewhere in the London Area and at Durham.

Taraxacum officinale appears to be twice as frequent as a wall plant in Cambridge and Durham than in Middlesex, though the reasons for this are obscure. *Antirrhinum majus* is slightly less frequent in other parts of the London Area than in Middlesex, but is over three times more frequent in Cambridge than in Middlesex. *Sambucus nigra* also is more than three times more frequent in Cambridge and Durham than in Middlesex. The much higher frequency of *Antirrhinum majus* and *Sambucus nigra* in Cambridge may perhaps be explained by the greater age of many of the walls in that city.

HABITAT FACTORS

(a) *Materials used in construction of walls*

Most Middlesex walls are constructed of brick, but a few concrete and some stone walls have been noted. The best habitats for plants are provided by old brick walls whose crumbling mortar reveals crevices where seeds may lodge, germinate, and flourish. The tops of old walls also provide sanctuary for many plants. Walls of recent origin usually harbour very few species, though even these often have a few tufts of the ubiquitous *Poa annua* growing on their tops to the exclusion of other plants.

Woodell and Rossiter (1959) found that old brick walls provided more plants on the average than stone walls, and this also is the case in Middlesex. Grose (1957) records that the flora of brick walls and bridges in Wiltshire is very meagre, though limestone walls in the county provide a variety of plants.

(b) *Moisture*

The degree to which walls retain moisture is determined mainly by the materials of which they are constructed. Old brick walls are sometimes extremely porous, and in wet weather will absorb and retain a considerable amount of water. In dry weather, however, they quickly lose their moisture content by the process of evaporation.

Haines (1947) and Rishbeth (1948) both noted that an intermittent overflow of water from a defective gutter or waste pipe often allowed the establishment of plants on the vertical sides of walls which are otherwise normally bare. These observations were confirmed at Ealing in 1958 when a defective waste pipe resulted in the establishment of a luxuriant and trailing growth of *Poa annua* high on the flank wall of a house. When the pipe was repaired the plants quickly died. Similarly, defective guttering on a farmyard barn near Uxbridge was responsible for the growth of a lush mat of *Agrostis stolonifera*, and robust plants of *Pteridium aquilinum* and *Dryopteris filix-mas* on the barn wall.

Haines (1947) considered that moisture was the most important factor influencing the establishment and survival of wall plants, but Woodell and Rossiter (1959) suggested that while the moisture content of walls was important to seedlings and small annuals, it was of less importance to well established plants, which seemed little affected, even in a prolonged dry summer. Turrill (1959) also refers to a number of trees, one of which is estimated to be over 60 years old, growing on the hot dry south boundary wall of Cambridge Cottage garden, Kew. Nevertheless, the hot dry summer of 1959 was apparently responsible for the high mortality rate among many Middlesex wall plants, including trees which had been established for years.

(c) *Shade*

Rishbeth (1948) considered that shade was important in determining the time during which a wall remained moist after rain, and gave examples of species preferring shade (*Acer pseudoplatanus*, *Asplenium ruta-muraria* and *Pteridium aquilinum*), and those preferring sunny situations (*Sedum acre*, *Cheiranthus cheiri*, *Senecio vulgaris* and *Festuca rubra*). Woodell and Rossiter (1959) were, however, of the opinion that although mosses and seedlings were affected by shading, there was no convincing evidence that higher plants were affected.

Aspect is important to some species, particularly pteridophytes, e.g.

of the 21 Middlesex walls on which *Phyllitis scolopendrium* was noted, 12, or 57.1%, were east facing, eight, or 38.1%, were north facing, and only one, or 4.8%, was south facing. *Asplenium trichomanes* was seen only on north facing walls, and *Polypodium vulgare* only on walls with an eastern aspect. Walls heavily shaded by trees sometimes bear a few bryophytes but rarely have vascular plants growing on them.

(d) Air pollution

In common with most other built-up areas atmospheric pollution fluctuates considerably in Middlesex, being relatively high at certain times during the autumn and winter months and less concentrated during the months of spring and summer. The types of air pollution are very diverse and are controlled by various factors including wind direction, which determines the areas to which the pollution is directed, and rainfall which assists in the deposition of the pollutants.

The most common air pollutants are coal smoke, containing quantities of soot and sulphur dioxide, and carbon monoxide emitted from the engine exhausts of motor vehicles.

Bleasdale (1959) considers that "the environment for plant growth is affected in three ways by the presence of coal smoke, namely (1) by a reduction in the amount of light available to the plant, (2) by an alteration in soil conditions, and (3) by the contamination of the air by foreign gases". Cohen and Rushton (1911) showed, by a series of experiments, that rainfall in a polluted area reduced the number of bacteria present in the soil, and Bleasdale (1959) has pointed out that "this in turn, could result in a reduction in the availability of plant nutrients". He shows also that rain falling in polluted areas dissolves the acid pollutants from the atmosphere and leaches bases from the soil.

The present-day vegetation of Middlesex walls appears to be little affected by air pollution, but it is likely that certain atmospheric pollutants are responsible for the disappearance from walls of *Erophila* species and *Saxifraga tridactylites*. The former are usually over-wintering annuals flowering very early in the year, and Bleasdale (1959) has pointed out that "overwintering of many winter-growing species of plants is extremely difficult in polluted areas".

THE FLORA OF WALLS IN DIFFERENT SITUATIONS

Woodell and Rossiter (1959) have pointed out that the flora of a particular wall is influenced not only by its composition, aspect and exposure, but also by the character of adjacent vegetation, i.e. available sources of colonization.

The vegetation of six differently situated walls is listed below, with details of frequency of species and their availability.

(a) North facing brick wall of disused railway station, High Street, Uxbridge

Artemisia vulgaris r.
Asplenium trichomanes f.
Buddleja davidii o.
Chamaenerion angustifolium f.
Chaenorhinum minus r.
Clematis vitalba r.
Cymbalaria muralis f.
Dryopteris filix-mas r.

Epilobium adenocaulon r.
Hypochoeris radicata o.
Poa angustifolia f.
P. annua f.
Senecio squalidus f.
Solanum dulcamara o.
Vulpia myuros f.

With the exception of *Asplenium trichomanes* and *Buddleja davidii* all the species are frequent in the Uxbridge district. *Asplenium trichomanes* and *Cymbalaria muralis* were the only typical wall plants noted. *Chaenorhinum minus* and *Vulpia myuros* had migrated to the wall from nearby railway tracks where they were plentiful.

(b) South facing brick walls enclosing a nursery and gardens, Church Road, West Drayton

<i>Antirrhinum majus</i> o.	<i>Plantago lanceolata</i> r.
<i>Arenaria serpyllifolia</i> f.	<i>Poa annua</i> o.
<i>Buddleja davidii</i> o.	<i>P. pratensis</i> o.
<i>Centranthus ruber</i> o.	<i>Reseda luteola</i> o.
<i>Chamaecyparis lawsoniana</i> r.	<i>Sagina procumbens</i> f.
<i>Cymbalaria muralis</i> f.	<i>Sedum acre</i> a.
<i>Corydalis lutea</i> o.	<i>Senecio squalidus</i> f.
<i>Hieracium strumosum</i> a.	<i>S. vulgaris</i> f.
<i>Hypericum perforatum</i> a.	<i>Solanum dulcamara</i> f.
<i>Larix decidua</i>	<i>Solidago altissima</i> r.
<i>Myosotis ramosissima</i> f.	<i>Sonchus oleraceus</i> f.
<i>Phyllitis scolopendrium</i> r.	<i>Vulpia bromoides</i> o.

This short series of walls is one of the most interesting in the county from the botanical viewpoint, and the wall enclosing the nursery is undoubtedly one of the oldest in west Middlesex. *Cymbalaria muralis*, *Plantago lanceolata*, *Poa annua*, *P. pratensis*, *Sagina procumbens*, *Sedum acre*, *Senecio squalidus*, *S. vulgaris*, *Solanum dulcamara*, *Sonchus oleraceus* and *Vulpia bromoides* are common in the West Drayton area. Typical wall plants were *Centranthus ruber* and *Corydalis lutea*, no doubt established escapes from nearby gardens, *Cymbalaria muralis*, *Phyllitis scolopendrium* and *Sagina procumbens*. *Chamaecyparis lawsoniana* occurred as seedlings, probably originating from the nursery, and *Larix europea* as a solitary seedling, probably from a mature tree in the nearby churchyard. A most unusual feature was the abundance of *Hypericum perforatum*, which had obviously been established for many years. It is difficult to trace the means by which this species became introduced, but possibly it was common in adjacent grassland before the district became built-up.

(c) South-east facing brick wall, Oaks Road, Stanwell

<i>Agrostis stolonifera</i> o.	<i>Lolium perenne</i> o.
<i>Antirrhinum majus</i> o.	<i>Poa angustifolia</i> f.
<i>Arenaria serpyllifolia</i> f.	<i>P. annua</i> f.
<i>Asplenium ruta-muraria</i> v.a.	<i>Pteridium aquilinum</i> f.
<i>Conyza canadensis</i> a.	<i>Rumex acetosella</i> r.
<i>Dryopteris filix-mas</i> o.	<i>Sagina procumbens</i> f.
<i>Epilobium adenocaulon</i> f.	<i>Sambucus nigra</i> r.
<i>E. montanum</i> r.	<i>Senecio squalidus</i> a.
<i>E. obscurum</i> r.	<i>Solanum dulcamara</i> o.
<i>Euphorbia peplus</i> r.	<i>Sonchus oleraceus</i> f.
<i>Lamium album</i> o.	<i>Urtica dioica</i> o.

With the exception of *Antirrhinum majus*, *Asplenium ruta-muraria* and perhaps *Rumex acetosella*, all the plants noted are common in the Stanwell district. An interesting feature of this very old wall is the extreme abundance of *Asplenium ruta-muraria*.

(d) South-west facing brick wall, enclosing old garden, Stanmore Hill, Stanmore.

<i>Chamaenerion angustifolium</i> o.	<i>Poa angustifolia</i> r.
<i>Epilobium adenocaulon</i> o.	<i>Sedum acre</i> a.
<i>Hypochoeris radicata</i> r.	<i>Senecio squalidus</i> r.
<i>Lamium album</i> r,	<i>Taraxacum officinale</i> r.

With the exception of *Sedum acre*, all the plants seen are common in the Stanmore area, and the wall possessed no particularly interesting features. It did, however, harbour a flora typical of many similar walls in other parts of the county.

(e) East facing brick wall of Highgate Cemetery, Swains Lane, Highgate

<i>Acer pseudoplatanus</i> o.	<i>Fraxinus excelsior</i> r.
<i>Achillea millefolium</i> r.	<i>Plantago lanceolata</i> r.
<i>Antirrhinum majus</i> f.	<i>Poa angustifolia</i> f.
<i>Arrhenatherum elatius</i> f.	<i>P. annua</i> f.
<i>Betula pendula</i> f.	<i>Pteridium aquilinum</i> o.
<i>Buddleja davidii</i> f.	<i>Sagina procumbens</i> o.
<i>Calystegia sepium</i> r.	<i>Sedum acre</i> o.
<i>Chamaenerion angustifolium</i> f.	<i>Senecio squalidus</i> f.
<i>Cymbalaria muralis</i> f.	<i>Solanum dulcamara</i> o.
<i>Dryopteris filix-mas</i> o.	<i>Sonchus oleraceus</i> r.

With the exception of *Antirrhinum majus*, *Buddleja davidii* and *Sedum acre*, all the plants noted are common about Highgate. The seedlings and saplings of *Acer pseudoplatanus* and *Betula pendula* probably originated from mature trees in the cemetery.

(f) West facing brick railway bridge, Rickmansworth Road, Northwood

<i>Arrhenatherum elatius</i> r.	<i>Fraxinus excelsior</i> r.
<i>Artemisia vulgare</i> r.	<i>Plantago lanceolata</i> r.
<i>Buddleja davidii</i> o.	<i>Senecio squalidus</i> o.

Arrhenatherum elatius, *Artemisia vulgare*, *Plantago lanceolata* and *Senecio squalidus* had undoubtedly spread on to the brickwork from nearby railway banks where all four species were plentiful. *Fraxinus excelsior* is quite common in the Northwood district, but *Buddleja davidii* appears to be little grown in gardens.

CHANGES IN THE WALL FLORA

(a) Lost and dwindling species

During the last century certain species formerly common in mural habitats have become rare, or are no longer found growing in such situations.

Trimen and Dyer (1869) refer to *Papaver rhoeas* and *P. dubium* as being locally abundant on wall tops in various parts of the county. It is likely that the "old" walls of a century ago had a good deal of mud used in their construction, and that seeds of *Papaver* species were introduced by this means. The wholesale destruction of most of the cornfields of the county by the builder, and the introduction of modern grain cleaning methods, have resulted in *Papaver* species now being more or less casual on waste ground, rubbish-tips and about railway premises.

Diploxys tenuifolia was common on walls from the sixteenth century until the late nineteenth century, when it became very rare. It is locally abundant on waste ground and walls and about railway premises in north Kent, and since the end of the war has spread back into Middlesex via

the railway system and bombed sites. Although it is very plentiful and increasing on waste ground and bombed sites in the eastern part of the county, it has not yet been noted recolonizing walls.

Erophila species and *Saxifraga tridactylites* were apparently widespread and locally common on the walls of Middlesex until the latter part of the nineteenth century. They are now extremely local in the county, and the former are no longer known to grow on walls. As stated earlier it is likely that atmospheric pollution is responsible for their decline. Harrison (1960) comments on the strange disappearance of *Erophila verna* from lowland areas of Durham and Northumberland.

Geranium lucidum was apparently a very local species of stone walls until about 1920. The demolition of these walls and their replacement by brick walls, which do not appear to provide suitable habitats for the plant, has almost resulted in its extinction.

(b) *The alien element*

Fifty-one, or 25%, of the plants noted on Middlesex walls are of foreign origin, many of them originating as escapes from cultivation. Some of these plants have been present for a long time—*Conyza canadensis*, a native of North America, was first recorded by Tancred Robinson in 1690 and was even then quite common about London (Ray, 1690), while *Cymbalaria muralis* from southern Europe was noted to be plentiful on walls at, and near, the Physic Garden, Chelsea as early as 1724 (Dillenius, 1724). Other species, however, rare or unknown to nineteenth century botanists, have now successfully colonized walls and are still spreading.

Epilobium adenocaulon, a North American plant, was first recorded from Britain in 1935 (Ash and Sandwith, 1935), though it was later shown that it had been present as early as 1894 (Chapple, 1935). It was not detected in Middlesex until 1945, when it was found growing on bombed sites in the City (Lousley, 1947), but the species had obviously been present in the county for some years, though overlooked. It is now a common plant of walls, waste ground, stream banks and roadsides in all parts of the county.

Chamaenerion angustifolium was known to Trimen and Dyer (1869) as a rare plant of woods and banks. At the end of the nineteenth century it began to spread, colonizing heaths, railway banks and waste ground. Later it migrated to walls and is now a common constituent of the floral cover of wall tops all over the county. Harrison (1953 and 1956) has pointed out that in Durham there are two forms of *C. angustifolium*, a locally restricted upland native form, and an aggressive spreading lowland form of adventive origin. The latter was possibly introduced from North America and formerly cultivated as a garden plant. Differences in flower-colour, leaf-structure and growth habit between the two forms are given. This may well explain the rapid increase of the plant in other parts of Britain.

Buddleja davidii, a native of China, was introduced into British gardens about 1890. An attractive shrub with long panicles of purple flowers, so beloved by butterflies, it sets seed very freely, and was apparently first noted as an established escape in Merioneth, North Wales, in 1922 (Druce, 1925). The first record for Middlesex was made in 1927 (Melville and Smith, 1928), and since that time it has spread considerably, and is now commonly seen growing from the perpendicular sides of walls and buildings.

Senecio squalidus, a south European plant, was cultivated in the Oxford Botanic Garden as early as the seventeenth century, and by the end of the eighteenth century had escaped and become established on the walls of that city (Sibthorp, 1794). With the advent of the railway it spread rapidly along the system to many parts of England and to South Wales. It reached Middlesex early in the present century (Kent, 1960), and soon began colonizing railway premises, waste ground and walls in the western parts of the county. During the last thirty years it has spread rapidly away from the railway to all parts of Middlesex, and is now one of the most frequent plants noted on wall tops.

Solidago altissima, from North America, has long been a favourite garden plant (Golden Rod) in Britain. Its fruits, which are plumed with silky hairs, like those of *Senecio squalidus*, are readily borne by the wind, and the plant is now a quite common feature on the tops of old walls.

DISPERSAL

Having discussed some of the large variety of plants which may be found growing on walls, the problem arises as to how they find their way to such habitats. There are various means by which plant seeds may reach walls—by the action of wind, through birds and other animals, by ants (Ridley, 1930) and perhaps other insects, in mud on the footwear of children and by deliberate introduction by man.

The means of dispersal of the various plants found on walls is of particular interest, and in Table 4 an analysis of the plants is given under their types of dispersal mechanism. Comparisons are made also with the Cambridge and Durham lists.

	Table 4											
	DISPERSAL MECHANISM OF WALL PLANTS											
	Middlesex Walls				Cambridge Walls				Durham Walls			
	Species	Site	Records		Species	Site	Records		Species	Site	Records	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
ANIMAL												
Fleshy	25	12.2	115	5.1	20	13	89	7	21	12.5	100	13.1
Nuts	2	1	3	.1	—	—	—	—	—	—	—	—
Adhesive	3	1.5	10	.5	5	3	44	4	4	2.4	17	2.2
WIND	39	19.1	930	41.6	79	50	564	45	34	20.2	229	30.1
NO SPECIAL MECHANISM	135	66.2	1177	52.7	58	34	560	44	106	63.1	402	52.8
OTHERS (Explosive, etc.)	—	—	—	—	—	—	—	—	3	1.8	14	1.8
	204	100	2235	100	162	100	1257	100	168	100	762	100

It will be seen that 66.2% of the species found on Middlesex walls apparently possess no special dispersal mechanism. This is in accord with the findings of Woodell and Rossiter (1959) at Durham, where 63.1% of the species noted were apparently without special dispersal mechanism. It is interesting to note that in this category the actual site records for Middlesex amounted to 52.7%, compared with 52.8% in Durham. The means by which such a high proportion of plants of this type reached and became established on walls is complex and difficult to assess. Woodell and Rossiter (1959) note that “ the immediate conclusion is that their seeds are carried on to walls by wind, but though this may be the correct conclusion it is very difficult to obtain any real evidence for such dispersal ”. It seems likely, also, that some of these plants reach walls as seeds contained in mud on the feet of birds. Clifford (1956) has shown that many

seeds are carried in the mud on footwear, and it is possible that some plants may be introduced *via* mud on the footwear of children climbing over walls; it is unlikely, however, that this means of dispersal is of much importance. Ridley (1930) refers to the dispersal of plant seeds by ants, and mentions *Prunella vulgaris* as one species so distributed.

Included among the plants which apparently have no special dispersal mechanism are a number of very common weeds, e.g. *Capsella bursa-pastoris*, *Stellaria media*, *Polygonum persicaria*, *Plantago major*, *P. lanceolata* and *Poa annua*. Some of these species have very rapid life cycles, and produce many generations and an enormous amount of seed during a single season. It would appear, therefore, that frequency, abundant production of seed and short distance dispersal enables some of these plants to compete favourably with species with special dispersal mechanism in colonizing mural habitats.

Wind-dispersed plants appear to be less well represented in Middlesex and Durham than in Cambridge, the total species for the respective places being 39 (19.1 %), 34 (20.2 %) and 79 (50 %). The high Cambridge figure is probably due to Rishbeth (1948) including not only plants with fruits with pappus or wings, but also many species with light seeds. Woodell and Rossiter (1959), on the other hand, included only plants whose fruits possessed pappus or well-developed wings. In the present survey I have followed Woodell and Rossiter, but have also included pteridophytes, whose spores are disseminated by wind and air currents.

The site records for wind-dispersal species in Middlesex number 930 (41.6 %) against 229 (30.1 %) for Durham. The higher Middlesex figure can be accounted for by the frequency of *Senecio squalidus*, a species which is absent from Durham.

Animal-dispersed plants are equally well represented in Middlesex (14.7 %), Cambridge (16 %) and Durham (14.9 %).

Birds are undoubtedly responsible for the occurrence of most of the fleshy-fruited species found on walls, the fruits either having been devoured as food, the seeds passing unharmed through the intestinal tracts of the birds, or merely dropped by birds. Twenty-five species with fleshy fruits were noted on Middlesex walls, and of these nine were noted growing on pollarded willows near Flatford Mill, in Suffolk, where they had been introduced by the same means (Cannon and Cannon, 1957). Further interesting observations on the dissemination of fleshy fruited trees, shrubs and herbs by birds in northern France are given by P. and M. Froment (1953), while similar data for Norway is provided by Grødem (1940).

Certain species with hooked or burred fruits, e.g. *Galium aparine*, *Geum urbanum* and *Circaea lutetiana*, may perhaps be introduced on to walls *via* the feathers of birds or the fur of cats.

A curious, but well known, fact is that *Cymbalaria muralis* has a most unusual method of dispersal; the pedicels of the plant become negatively phototropic after flowering, thus pushing the fruits into dark crevices in the wall where they deposit their seeds.

A few species are sometimes deliberately planted on wall tops for decoration, e.g. *Cheiranthus cheiri*, *Sedum acre*, *S. dasyphyllum* and *S. reflexum*, and eventually regenerate, or spread vegetatively.

THE LONGEVITY OF SOME WALL PLANTS

Although many plant species found on walls are merely transitory

others persist for a very long time. Jorden (1859) mentions a bush of *Salix caprea* which he had known growing on the top of a ten-foot wall for nearly fifty years, a miserable stunted bush which showed no visible difference in appearance for nearly thirty years, yet which bore fruit and regenerated. Rishbeth (1948) has shown that the root systems of trees growing on walls are very much distorted, and that the normal growth of these trees is consequently much restricted. Jorden (1859) gives further examples of longevity—in particular a small plant of *Rubus idaeus* which lived for c. 40 years, and a plant of *Solanum dulcamara* still in a flourishing state after twenty years.

More recently, Turrill (1959) has commented on a number of trees, one of which is estimated to be over sixty years old, growing on, and out of, the south boundary wall of Cambridge Cottage garden, Kew. There are six specimens of *Thuja orientalis*, of various heights up to fifteen feet, a laburnum, a pear and a lilac.

Two trees over five feet tall have been noted on Middlesex walls—*Sorbus aucuparia*, near Chiswick, and *Betula pendula* at Brentford. Specimens about four feet tall have been seen as follows:—*Acer pseudoplatanus* near Hillingdon; *Prunus spinosa*, Uxbridge; *Sorbus aucuparia*, East Bedfont; *Betula pendula*, Hampstead and Ken Wood, and *Fagus sylvatica*, Ken Wood.

Lastly, mention should be made of the persistence of *Mycelis muralis* on a wall near "The Spaniards" at Hampstead. First recorded by Trimen and Dyer (1869) it is still to be seen there to-day—a remarkable persistence, involving many generations of plants.

ACKNOWLEDGMENTS

I am indebted to P. D. Sell and C. West for identifying the species of *Hieracium* found on Middlesex walls, to Mrs. B. Welch for supplying plant lists from some Surrey walls, used for comparative purposes, and to J. E. Lousley for kindly reading and commenting on this paper.

REFERENCES

- ANZALONE, B., 1951, Flora e vegetazione dei muri di Roma. *Annali Bot.*, 23, 393-497.
 ASH, G. M. & SANDWITH, N. Y., 1935, Epilobium adenocaulon Hausskn. in Britain. *J. Bot.*, 73, 177-184.
 BLEASDALE, J. K. A., 1959, The effects of air pollution on plant growth, in YAPP, W.B. (Editor). *The Effects of Pollution on Living Material*, 81-87.
 CANNON, J. F. M. & M., 1957, The stability of the epiphytic flora of pollarded willows. *Proc. B.S.B.I.*, 2, 226-233.
 CHAPPLE, J. F. G., 1935, Epilobium adenocaulon Hausskn. in Herb. Druce. *J. Bot.*, 73, 237-238.
 CLIFFORD, H. T., 1956, Seed dispersal on footwear. *Proc. B.S.B.I.*, 2, 129-131.
 COHEN, J. B. & RUSHTON, A. G., 1911, *Smoke: A Study of Town Air*. London.
 DANDY, J. E., 1958, *List of British Vascular Plants*. London.
 DILLENIIUS, J. J., 1724, Ray's *Synopsis Methodica stirpium Britannicarum*. Edition 3. Edited by J. J. Dillenius. London.
 DRUCE, G. C., 1925, *Buddleia spectabilis* Kunth & Bouché. *Rep. Bot. Soc. & E.C.*, 7, 446.
 FROMENT, P. & M., 1953, Importance du rôle des oiseaux pour la dissémination de certains arbres et arbustes dans le gisements tourbeaux de la vallée de l'Ardon à Laon (Aisne). *Bull. Soc. Bot. Nord France*, 6, 6-7.
 GERARDE, J., 1597, *The Herball, etc.* London.
 GRODEM, K., 1940, Epifytiske karplanter omkring Kristiansand. *Nytt Mag. Nat.*, 80, 219-262.
 GROSE, D., 1957, *The Flora of Wiltshire*. Devizes.
 GUPPY, H. B., 1893, The River Thames as an agent in plant dispersal. *J. Linn. Soc., Bot.*, 29, 333-346.
 HAINES, R. W., 1947, Flowers of wall-tops. *St. Thomas's Hospital Gaz.*, 45 (6).
 HARRISON, J. W. HESLOP, 1953, The present position of the Rosebay willow herb. *Vasc. (Subst.)*, 38, 25.
 ———, 1956, The Rosebay Willow Herb. *Vasc. (Subst.)*, 41, 25.
 ———, 1960, The range of *Erophila verna*. *Vasc.*, 45, 18.
 JORDEN, G., 1859, Mural plants. *Phyt.*, N.S., 3, 47-50.
 KENT, D. H., 1960, *Senecio squalidus* L. in the British Isles, 2. The spread from Oxford (1879-1934). *Proc. B.S.B.I.*, 3, 375-379.
 ——— & LOUSLEY, J. E., 1951-57, *A Hand-List of the Plants of the London Area*, Supplement *Lond. Nat.*, 30-36. 7 parts,

- LOUSLEY, J. E., 1947, Botanical records for 1946. *Lond. Nat.*, 26, 73-78.
 MELVILLE, R., & SMITH, R. L., 1928, Adventive flora of the Metropolitan Area. *Rep. Bot. Soc. & E.C.*, 8, 444-454.
 RAY, J., 1690, *Synopsis Methodica stirpium Britannicarum*. London.
 RICHARDS, P. W. M., 1928, Ecological notes on the bryophytes of Middlesex. *J. Ecol.*, 16, 269-300.
 RIDLEY, H. N., 1930, *The Dispersal of Plants throughout the World*. Ashford.
 RISHBETH, J., 1948, The flora of Cambridge walls. *J. Ecol.*, 36, 136-148.
 SIBTHORP, J., 1794, *Flora Oxoniensis*. Oxford.
 TRIMEN, H. & DYER, W. T. T., 1869, *Flora of Middlesex*. London.
 TURNER, G., 1951, Observations on the flora of some walls near the school. *Mag. Blundell's School Sci. Soc.*, 6, 55-59.
 TURNER, W., 1548, *The Names of Herbes, etc.* London.
 TURRILL, W. B., 1959, *Royal Botanic Gardens, Kew*, London.
 WEST, W., 1911, Mural ecology. *J. Bot.*, 49, 59-61.
 WOODDELL, S. R. J. & ROSSITER, J., 1959, The flora of Durham walls. *Proc. B.S.B.I.*, 2, 257-273.
 YAPP, W. B. (Editor), 1959, *The Effects of Pollution on Living Matter*; Symposia of the Institute of Biology, No. 8. London.

A Hand List of the Plants of the London Area

compiled from the botanical records of
 THE LONDON NATURAL HISTORY SOCIETY

BRYOPHYTES

By J. H. G. PETERKEN, F.L.S.

PREFACE

IN the *London Naturalist*, 30-35, 1951-1956, was published *A hand list of the Flowering Plants, Ferns and Stoneworts of the London Area*. To that is now added the Mosses and Liverworts, this being the first list of this group published by the Society.

The London Area is defined as including all places within twenty miles of St. Paul's Cathedral—a map of the area was published in the *London Naturalist*, 30, 1951.

The following list has been compiled from records sent in by past and present members of the L.N.H.S. and from published records of the Hertfordshire Natural History Society and the Essex Field Club, some of whose members were also members of the L.N.H.S. Extracts have also been taken from the *Transactions* of the British Bryological Society, most of whose London members are also members of our own Society. The records marked E.C.W. were partly sent in direct and partly taken from an article by E. C. Wallace on Surrey bryophytes in the *Journal of Botany*, 78-79, 1940-1941. Those records marked R.A.B. were partly sent in direct and partly taken from an article by R. A. Boniface on Hepatics of the London Area in the *London Naturalist*, 28, 1949.

The records have been arranged according to the Watsonian vice-county system. The boundaries of the vice-counties are as originally defined by H. C. Watson in 1859 (*Cybele Britannica*, 4, 139 seq.) and repeated by him in *Topographical Botany* (Ed. 1, 1, 21 seq.) in 1873, and no subsequent administrative alterations can be recognized in botanical records.

The vice-counties of which parts fall within the London Area are as follows:

V.-c. 16 West Kent
 18 South Essex
 20 Herts
 24 Bucks

V.-c. 17 Surrey
 19 North Essex
 21 Middlesex

Thanks are due to the members who have sent in records; to E. C. Wallace for looking through the final draft and for providing the records of Dr. E. F. Warburg for Surrey, 1943-47; to D. H. Kent for the loan of Professor P. W. Richards' records for Middlesex, 1922-1927 and to Dr. T. D. V. Swinscow for the loan of the Herts. Natural History Society *Transactions*.

PLAN OF THE HAND LIST

1. NOMENCLATURE

The nomenclature adopted is based on *An annotated list of British Mosses* by P. W. Richards and E. C. Wallace for mosses and *An Annotated list of British Hepatics* by Eustace W. Jones for liverworts, both published by the British Bryological Society. In addition some alterations in nomenclature published later in the *Transactions* of the British Bryological Society have been given effect to and a new species *Tortella inflexa* has been added.

2. GENERAL OUTLINE

The entries are arranged as follows:—

- (1) Scientific name of the species, followed by synonyms where it is desirable to facilitate reference to older works.
- (2) Habitat and general frequency in the area.
- (3) Records arranged according to Watsonian vice-counties.
- (4) Individual records, date where important and recorders' initials. The sign ; is used between different localities recorded by the same members.

INDEX TO RECORDERS' NAMES

A.G.S.	Side, Mrs. A. G.	F.R.	Rose, F.
A.H.N.	Norkett, A. H.	H.B.	Banks, H.
B.T.W.	Ward, B. T.	J.F.	Farrand, J.
C.A.	Avery, C.	J.H.G.P.	Peterken, J. H. G.
C.H.A.	Andrewes, C. H.	J.R.	Ross, J.
C.L.C.	Collenette, C. L.	K.C.H.	Harris, K. C.
C.P.C.	Castell, C. P.	P.C.H.	Holland, P. C.
D.H.K.	Kent, D. H.	P.W.R.	Richards, P. W.
E.C.W.	Wallace, E. C.	R.A.B.	Boniface, R. A.
E.F.W.	Warburg, E. F. (per ECW)	R.M.P.	Payne, R. M.
E.S.	Saunders, E.	T.D.V.S.	Swinscow, T. D. V.
F.E.W.	Wrighton, F. E.		

REFERENCES

- E.N.* *Essex Naturalist*, 1920.
E.N. 20. *Essex Naturalist*, Vol. 20.
L.N. 1949. *London Naturalist*, 28, 1949—"Hepatics of the London Area" by R. A. Boniface.
Tr. B.B.S. 1949, 1950, 1951. *Transactions* of the British Bryological Society—"A Bryophyte Flora of Kent" by F. Rose.
Tr. H. 1884, 1893, 1896, 1917. *Transactions* of the Herts. Natural History Society.

HEPATICAЕ

ANTHOCEROTALES

ANTHOCEROTACEAE

ANTHOCEROS L

A. PUNCTATUS L., damp ground, rare. V.-c. 20, meadow near Langley Way, 1957; F.R. per T.D.V.S.

SPHAEROCARPALES

SPHAEROCARPACEAE

SPHAEROCARPOS Ludwig

S. TEXANUS Austin, damp ground, rare. V.-c. 16, Abbey Wood, 1919; *Tr. B.B.S.* 1949. "Probably extinct in this locality". F.R.

MARCHANTIALES

REBOULIACEAE

REBOULIA Raddi

R. HEMISPHAERICA (L.) Raddi, on rocks, rare. V.-c. 16, Sydenham Wells, 1805; *Tr. B.B.S.* 1949.

MARCHANTIACEAE

CONOCEPHALUM Weber

C. CONICUM (L.) Dum., ditches, stream banks, walls by streams, not uncommon. V.-c. 16, Chislehurst, 1907; *Tr. B.B.S.* 1949. V.-c. 17, near Chessington; Mickleham; *L.N.* 1949. V.-c. 19, Cobbins Brook near Epping Bury, 1951; B.T.W. V.-c. 20, Wormley Woods, 1950; E.C.W.; Bayford Wood, 1956; T.D.V.S.; near Roxford Farm; *Tr. H.*, 1893. V.-c. 21, Town Park, Enfield; *L.N.*, 1949. V.-c. 24, Oak End, Denham; *L.N.*, 1949.

LUNULARIA Adans.

L. CRUCIATA (L.) Dum., stream banks, damp ground and greenhouses, not uncommon on the chalk, occasional elsewhere. V.-c. 16, Mottingham, 1907; Avery Hill Greenhouses; Abbey Wood; Dartford Heath; *Tr. B.B.S.* 1949; Keston Common; Hayes Common; Joydens Wood; F.R. V.-c. 17, Oxted; Boxhill; J.H.G.P.; Norbury Park; E.C.W.; Bookham Common; C.P.C. V.-c. 18, Epping Forest, 1942; Wanstead Park, 1961; J.H.G.P. V.-c. 20, Essendon (in garden pots); Wormley Bury; *Tr. H.* 1893; Rickmansworth, 1949; J.H.G.P. V.-c. 21, Grand Union Canal, Harefield, 1927; P.W.R.

MARCHANTIA Raddi

M. POLYMORPHA L., wet banks, damp walls, common locally. V.-c. 16, Farningham Wood, 1946; R.A.B.; Plumstead, 1961; J. Cooper. V.-c. 17, Thames bank in various places; R.A.B.; Chessington; A.H.N.; Woodcote Park, Epsom; E.C.W.; Bookham Common; C.P.C. V.-c. 18, Leyton; Snaresbrook; Epping Forest; J.H.G.P. V.-c. 20, Essendon; Broxbourne; St. Albans; Panshanger; *Tr. H.* 1893. V.-c. 21, Cripple-gate; Shepherds Bush; J.H.G.P.; Hampstead; canal side at Uxbridge; R.A.B.; Hampton Court; F.R.; Grays Inn Road; E.C.W.; Osterley Park; C.P.C.; Hampstead Woods, 1927; P.W.R. V.-c. 24, Canal side, Uxbridge to Denham; *L.N.*, 1949; Black Park, 1952; J.H.G.P.

RICCIACEAE

RICCIA L.

R. GLAUCA L., bare ground in fields, rides, etc., rare. V.-c. 16, Woolwich Heath (Dillenius); Abbey Wood; Keston Common; *Tr. B.B.S.*, 1949. V.-c. 17, Norbury Park; *L.N.*, 1949. V.-c. 20, Millwards Park, 1956; T.D.V.S. and F.R.; near Langley Bury and near Hatfield, 1957; T.D.V.S.

R. SOROCARPA Bisch., fallow fields, damp ground, not common. V.-c. 16, Keston Common; Farningham Wood; Joydens Wood; near Orpington; Abbey Wood; *Tr. B.B.S.*, 1949. V.-c. 17, cart rut on Boxhill, 1948; J.H.G.P. V.-c. 18, Navestock Heath, 1959; E.S.

R. FLUITANS L., floating in ponds and on mud by ponds, common. V.-c. 16, Well Hall, 1907; near Eltham, 1907; Abbey Wood, 1925; *Tr. B.B.S.*, 1949. "Rare to-day in Kent". F.R., 1949. V.-c. 17, Weybridge; Bookham Common; C.P.C.; Burgh Heath, 1939; E.C.W. V.-c. 18, Epping Forest, 1942, clinging to stems of *Utricularia*; J.H.G.P. V.-c. 20, Broxbourne Common; Broxbournebury ponds; by Wormley West Wood; *Tr. H.* 1893; pond near Bayford, 1942; J.H.G.P.; Broad Riding Wood; Blackfan Wood, 1956; T.D.V.S. V.-c. 21, Hampstead Heath, 1949; per R.A.B.; Ruislip reservoir, 1949; F.E.W.; Hampton Court; pond near Stanmore Heath; *L.N.*, 1949.

R. CRYSTALLINA L., now extinct in London area. V.-c. 16, near Deptford Lock, 1724; *Tr. B.B.S.*, 1949. V.-c. 20, Little Berkhamsted; Panshanger; near Ball's Wood; Broxbourne; *Tr. H.*, 1893.

RICCIOCARPUS Corda

R. NATANS (L.) Corda, floating in ponds, rare. V.-c. 18, Epping Forest, Lower Wake Valley pond, 1942; J.H.G.P. V.-c. 20, Broxbourne Bury; Brickendon; between Bayford and Little Berkhamsted; Wormley Wood; Blackfan Wood; between Brickendon Green and How Clay pits; *Tr. H.*, 1893. V.-c. 21, Canal backwater, West Drayton, 1943; H.B., per C.P.C.

METZGERIALES

RICCARDIACEAE

RICCARDIA S. F. Gray

R. MULTIFIDA (L.) S. F. Gray, wet ground and ditches, not common. V.-c. 16, Holwood Park; *L.N.*, 1949; Joyden's Wood; R.A.B. V.-c. 17, Reigate Hill, 1940; E.C.W.; Bookham Common; A.H.N.; Limpsfield Common; C.P.C. V.-c. 18, Epping Forest; C.P.C. V.-c. 20, Tunnel Woods, Watford; Little Berkhamsted; Hatfield Woodside; Box Wood; Wormley Wood; Kentish Lane bog; *Tr. H.*, 1893; Bencroft Wood; Bayford Wood; Bricket Wood, 1956; T.D.V.S. V.-c. 21, Highgate golf links, 1916; C.H.A.

R. SINUATA (Dicks.) Trev., heaths, rare. V.-c. 16, Swanscombe Wood; F.R. V.-c. 17, Bookham Common, 1948; C.P.C. V.-c. 19, Upshire, 1960; E.S. V.-c. 21, Hendon, 1926; P.W.R. V.-c. 24, Denham Golf Club; *L.N.*, 1949.

R. PINGUIS (L.) S. F. Gray, wet and boggy ground, not common. V.-c. 16, Keston bog, 1949; Farm Wood and Swanscombe Wood; F.R.; near Farningham Wood; R.A.B. V.-c. 17, Chessington, 1946; A.H.N.; Esher Common, 1947; J.H.G.P. V.-c. 18, Chigwell Row; *L.N.*, 1949. V.-c. 20, Tunnel Woods, Watford; Hertford Heath; Little Berkhamsted; Box Wood; Kentish Lane bog; *Tr. H.*, 1893.

PELLIACEAE

PELLIA Raddi

P. EPIPHYLLA (L.) Corda, ditches and damp ground, common in all areas.

P. FABBRONIANA Raddi, ditches, damp ground, path sides, etc., not very common. V.-c. 16, Downe; Shoreham; Greenhithe; Joydens Wood; F.R. and R.A.B. V.-c. 17, Chessington, 1946; A.H.N.; Norbury Park; C.P.C.; Boxhill; E.C.W. V.-c. 20, Tunnel Woods, Watford; Panshanger Park; *Tr. H.*, 1893; Bricket Wood, 1917; E. J. Salisbury; In and north of Wormley Wood, 1956; T.D.V.S. V.-c. 21, Thames banks, 1928; P.W.R.; Springwell chalkpit, Harefield; R.A.B.

METZGERIACEAE

METZGERIA Raddi

M. FURCATA (L.) Dum., on trees, not common. V.-c. 16, Joydens Wood; R.A.B.; Downe; Shoreham; F.R. V.-c. 17, Boxhill, 1942; Bookham Common; J.H.G.P.; Fetcham Downs; C.P.C.; Norbury Park; E.C.W. and C.P.C. V.-c. 18, Epping Forest, one very small piece on one tree, 1943; J.R. V.-c. 20, Panshanger Park; Broxbourne Common; *Tr. H.*, 1893; Wormley Woods; E.C.W. and J.H.G.P.; Millwards Park; Danemead Wood; Spital Brook valley, 1956; T.D.V.S. V.-c. 21, Harefield, 1950; D.H.K.

PALLAVICINIACEAE

PALLAVICINIA S. F. Gray emend Lindenb.

P. LYELLII (Hook.) S. F. Gray, boggy ground, very rare. V.-c. 17, Wimbledon Common, 1943; F.R.

BLASIACEAE

BLASIA L.

B. PUSILLA L., sandy ground, rare. V.-c. 17, Oxshott Heath, 1947; J.H.G.P.

FOSSOMBRONIACEAE

FOSSOMBRONIA Raddi

F. PUSILLA (L.) Dum., damp ground, not common. V.-c. 17, Bookham Common; A.H.N. V.-c. 19, Theydon golf course, 1959; E.S. V.-c. 20, Box Wood; Broxbourne Wood; Tunnel Woods, Watford; Bricket Wood; Hertford Heath; *Tr. H.*, 1893; Broxbourne Wood, 1950; E.C.W.; Millwards Park; Hawkshead Wood, 1956; T.D.V.S. V.-c. 21, Highgate golf links, 1916; C.H.A.; Ruislip Woods, 1947; J.H.G.P.; Ruislip Common; *L.N.*, 1949.

F. WONDRACZEKII (Corda) Dum., damp ground, rare. V.-c. 16, Joyden's Wood; R.A.B. V.-c. 17, Bookham Common; A.H.N. V.-c. 20, Bishops Wood, 1956; T.D.V.S.

JUNGERMANNIALES

PTILIDIACEAE

PTILIDIUM Nees

P. CILIARE (L.) Hampe, heaths and moors, very rare. V.-c. 17, Oxshott Heath; R.A.B. V.-c. 20, Panshanger Park; *Tr. H.*, 1893.

P. PULCHERRIMUM (Weber) Hampe, horizontal or inclined branches of trees, rare. V.-c. 16, Joyden's Wood (on oak); F.R. V.-c. 17, Boxhill (two places on sallow and birch); E.C.W. V.-c. 18, Epping Forest, 1943, (on hornbeam); J.R. V.-c. 20, Millwards Park, 1956 (on fallen oak); T.D.V.S. and F.R.; Hawkshead Wood and between Essendon and Hatfield (on oak); T.D.V.S.

TRICHOCOLEA Dum., corr. Nees

T. TOMENTELLA (Ehr.) Dum., bogs, very rare. V.-c. 16, Holwood, 1921; St. J. Marriott. V.-c. 20, Wormley Wood; *Tr. H.*, 1893.

LEPIDOZIACEAE

LEPIDOZIA (Dum.) Dum.

L. REPTANS (L.) Dum., rotten wood, moist banks, damp heaths, common. V.-c. 16, Farnborough, 1940; J.H.G.P.; St. Paul's Cray Common; Darenth Wood; Holwood Park; Joyden's Wood; Petts Wood; Abbey Wood; *L.N.*, 1949. V.-c. 17, Oxshott Heath; R.A.B.; Boxhill; C.P.C.; "on commons throughout the county"; E.C.W. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 20, Millwards Park; Hoddesdon Park Wood; between Essendon and Hatfield; T.D.V.S. V.-c. 21, Hampstead Woods; Stanmore and Harrow Weald Commons, 1927; P.W.R.; Ken Wood; R.A.B. V.-c. 24, Black Park; R.A.B.; Oak End, Denham; *L.N.*, 1949.

CALYPOGEIACEAE

CALYPOGEIA Raddi, corr. Corda

C. TRICHOMANIS (L.) Corda, emend. Buch, heaths, woods and banks, common. V.-c. 16, Keston; Joyden's Wood; R.A.B. V.-c. 17, "Common throughout the county"; E.C.W. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 20, Hertford Heath; Box Wood; Wormley Wood; Hatfield Woodside; *Tr. H.*, 1893; Hoddesdon Wood, 1942; J.H.G.P.; Bencroft Wood; Redwell Wood; Bayford Wood; Bricket Wood, 1956; T.D.V.S. V.-c. 21, Hampstead Woods; Stanmore Common, 1927; P.W.R.; West Heath, Hampstead, 1916; C.H.A.; Harrow Weald Common; R.A.B. V.-c. 24, Denham golf course; *L.N.*, 1949.

C. FISSA (L.) Raddi, heaths, woods and banks, common. V.-c. 16, Keston Common; Joyden's Wood; R.A.B.; St. Paul's Cray Common; F.R. V.-c. 17, Chessington; A.H.N.; Wimbledon Common; R.A.B.; Bookham Common; C.P.C. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 20, Bricket Wood; Hoddesdon Park Wood; Danemead Wood; Bencroft Wood; Bayford Wood; Millwards Park; *Tr. H.*, 1893; Wormley Wood; E.C.W.; Redwell Wood; R.A.B.; Bishops Wood; T.D.V.S. V.-c. 21, Ruislip Woods; Stanmore and Harrow Weald Commons, 1927; P.W.R.; Hampstead Heath and Ken Wood; R.A.B. V.-c. 24, Black Park; R.A.B.

C. ARGUTA Nees and Mont., moist banks, rare. V.-c. 17, Wimbledon Common; R.A.B.; Bookham Common; C.P.C. V.-c. 20, Bricket Wood; *Tr. H.*, 1917; Redwell Wood; Hoddesdon Wood; T.D.V.S.

LOPHOZIACEAE

LOPHOZIA (Dum.) Dum.

L. VENTRICOSA (Dicks.) Dum. on ground in woods and on heaths, common. V.-c. 16, Joyden's Wood; Keston Common; R.A.B.; Dartford Heath; Hollows Wood, Shoreham; F.R. V.-c. 17, no records

received but almost certainly in this area. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 20, Hertford Heath; *Tr. H.*, 1893. V.-c. 21, Park Wood, Ruislip; R.A.B.; Harefield; *L.N.*, 1949.

L. EXCISA (Dicks.) Dum., banks and heaths, rare. V.-c. 16, Joyden's Wood; F.R.

L. CAPITATA (Hook.) K. Müll. (*L. MILDEANA* (Gottsche) Schiffn.), heaths, rare. Hertford; *Tr. H.*, 1893.

L. INCISA (Schrad.) Dum., wet heaths, rare. V.-c. 20, Hertford Heath; Wormley Wood; *Tr. H.*, 1893.

L. BICRENATA (Schmid.) Dum., dry ground, rare. V.-c. 16, Keston Common; R.A.B.; Farm Wood; Joyden's Wood; F.R. V.-c. 17, Wimbledon Common; E.C.W.; Sheen Common; R.A.B. V.-c. 20, Hertford Heath; Northaw; *Tr. H.*, 1893; Danemead Wood, 1956; T.D.V.S. V.-c. 21, Hounslow Heath; R.A.B.

LEIOCOLEA (K. Müller) Buch

L. TURBINATA (Raddi) Buch, chalk hills and pits, fairly common in this habitat. V.-c. 16, Greenhithe; Downe; Shoreham; F.R. V.-c. 17, Common all along the chalk downs; E.C.W. V.-c. 20, Panshanger Park; *Tr. H.*, 1893; near Little Berkhamsted; T.D.V.S. V.-c. 21, Harefield; R.A.B.

TRITOMARIA Schiffn.

T. EXSECTIFORMIS (Breidl.) Schiffn. (*SPHENOLOBUS EXSECTIFORMIS* Steph.) peaty and sandy banks, rare. V.-c. 16, Joyden's Wood; R.A.B. V.-c. 17, Oxshott Heath; E.C.W.

GYMNOCOLEA (Dum.) Dum.

G. INFLATA (Huds.) Dum., damp heaths, common. Many records from all areas.

JUNGERMANNIACEAE

SOLENOTOMA Mitt. (*APLOZIA* Dum., *pro parte*)

S. CRENULATUM (Sm.) Mitt., wet ground, old cart ruts, etc., common. V.-c. 16, Keston; Joyden's Wood; St. Paul's Cray Common; Holwood Park; F.R. V.-c. 17, Wimbledon Common; near Kingswood Church; E.C.W. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 20, Colney Heath; Hertford Heath; *Tr. H.*, 1893; Bayford Wood; Wormley Wood; Oxhey Wood; Bencroft Wood; Millwards Park; Broxbourne Wood; Danemead Wood; T.D.V.S. V.-c. 21, Stanmore Heath; West Heath, Hampstead, 1928; P.W.R.; Harrow Weald Common; R.A.B.; Ruislip Woods; J.H.G.P.

PLECTOCOLEA (Mitt.) Mitt. (*EUCALYX* (Lindb.) Breidl.)

P. HYALINA (Lyell ex Hook.) Mitt., bare wet earth, rare. V.-c. 17, Bookham Common, 1947; A.H.N. V.-c. 20, Bayford Wood, 1956; T.D.V.S.

NARDIA S. F. Gray

N. SCALARIS (Schrad.) S. F. Gray, wet ground, old cart ruts, etc., common. V.-c. 16, Petts Wood; Keston Common; Joyden's Wood; Holwood Park; F.R. V.-c. 17, near Kingswood Church; E.C.W. V.-c. 18, Thorndon Park, Brentwood; E.S. V.-c. 20, St. Albans; Hertford Heath; *Tr. H.*, 1893; near Oxhey Woods; R.A.B.; Broxbourne Wood; Bishops Wood; Hoddesdon Park Wood; T.D.V.S. V.-c. 21, Stanmore and Harrow Weald Commons, 1927; P.W.R.; Ruislip Woods; J.H.G.P. V.-c. 24, Denham Golf Course; *L.N.*, 1949.

PLAGIOCHILACEAE

MYLIA S. F. Gray corr. Lindb. (LEPTOSCYPHUS Mitt.)

M. ANOMALA (Hook.) S. F. Gray, bogs, not common. V.-c. 16, Keston bog, 1951; F.R.

PLAGIOCHILA (Dum.) Dum.

P. ASPLENIODES (L.) Dum., shady places on calcareous and neutral soil, common. V.-c. 16, Joyden's Wood; R.A.B.; Farm Wood; Hollows Wood; Holwood Park; F.R. V.-c. 17, Woodcote Park, Epsom; E.C.W.; Boxhill; Oxted; J.H.G.P.; Weybridge, 1946; C.P.C. V.-c. 20, near Radlett; near Hertford; *Tr. H.*, 1893; Broxbourne and Wormley Woods, 1950; E.C.W. and J.H.G.P.; Danemead Wood, 1956; T.D.V.S. V.-c. 24, near Ninnings Farm, Maple Cross; *L.N.* 1949.

var. MAJOR Nees, habitat as type, less common. V.-c. 17, Boxhill; J.H.G.P. V.-c. 18, Curtis Mill Green; E.S.

HARPANTHACEAE

LOPHOCOLEA (Dum.) Dum.

L. BIDENTATA (L.) Dum., damp soil, grassland, banks, etc., apparently common throughout the area, though it is not always easy with barren material to distinguish between this and the following species.

L. CUSPIDATA (Nees) Limpr., tree stumps, rotting logs, etc., also sometimes on the ground, not common. V.-c. 16, Joyden's Wood; Downe; Shoreham; F.R. V.-c. 17, Boxhill; J.H.G.P.; Betchworth; E.C.W.; Fetcham; A.H.N.; Bookham Common; Limpsfield Common; Norbury Park; C.P.C. V.-c. 18, Chigwell Row; *L.N.*, 1949. V.-c. 20, "widespread on stumps and roots in woodland"; T.D.V.S. V.-c. 21, Ruislip Woods, 1927; P.W.R.; Queen's Wood, Highgate, 1916; C.H.A.; Bushy Park; R.A.B.

L. HETEROPHYLLA (Schrad.) Dum., dead logs, stumps, tree roots and wet ground. Very common throughout the area.

CHILOSCYPHUS Corda

C. POLYANTHOS (L.) Corda, stream and pond banks and wet ground, occasional. V.-c. 16, Petts Wood; F.R.; Holwood Park; *L.N.*, 1949. V.-c. 17, Bookham Common; C.P.C.; Fetcham; A.H.N.; Leatherhead; J.H.G.P.; Norbury Park; C.P.C.; Wimbledon Common; R.A.B. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 20, Box Wood; Wormley Wood; Hoddesdon Park Wood; Bayford Wood; Colney Heath; *Tr. H.*, 1893; Broad Riding Wood; Bencroft Wood; Danemead Wood; T.D.V.S.; Redwell Wood near South Mimms; J.H.G.P. V.-c. 21, Bushy Park; R.A.B.; Ruislip Woods; J.H.G.P.

C. PALLESCENS (Ehrh.) Dum., ditches and ponds, rare. V.-c. 21, Queen's Wood, Highgate, 1916; C.H.A.

CEPHALOZIELLACEAE

CEPHALOZIELLA (Spr.) Schiffn.

C. RUBELLA (Nees) Warnst., stumps, rare. V.-c. 17, Esher Common, on pine stump; E.C.W. (*L.N.*, 1949).

C. HAMPEANA (Nees) Schiffn., peaty and turfy ground, rare. V.-c. 17, Esher Common; E.F.W. (*L.N.*, 1949).

C. STARKEI (Funck) Schiffn., woods, ditches, heaths, occasional. V.-c. 16, Keston Common; St. Paul's Cray Common; F.R.; near Joyden's Wood; R.A.B. V.-c. 17, Sheen Common; R.A.B. V.-c. 20,

Bayford; Hertford Heath; *Tr.H.*, 1893; Bencroft Wood; Bishops Wood; Danemead Wood, 1956; T.D.V.S. V.-c. 21, Ruislip, 1927; P.W.R.; Highgate Golf Links, 1916; C.H.A.; Hampstead Heath; F.R.

CEPHALOZIACEAE

CEPHALOZIA (Dum.) Dum.

C. BICUSPIDATA (L.) Dum., wet ground, rotten wood, woods, etc., very common throughout the area.

C. CONNIVENS (Dicks.) Spr., wet heaths, rotten wood, etc., not common. V.-c. 16, Joyden's Wood; R.A.B.; Keston Common; F.R. V.-c. 17, Esher Common; R.A.B.; Oxshott Heath; E.C.W.; Wimbledon Common; C.A. V.-c. 20, Great Wood near Northaw, 1956; T.D.V.S. V.-c. 24, Black Park; R.A.B.

C. MEDIA Lindb., bogs, peaty and sandy banks, rare. V.-c. 16, Joyden's Wood; R.A.B.; Keston Common; F.R. V.-c. 17, Bookham Common; A.H.N.; Oxshott Heath; E.C.W.

CLADOPODIELLA Buch

C. FRANCISCI (Hook.) Buch, wet banks and ditches, rare. V.-c. 16, Holwood Park; E.C.W. and F.R. (*L.N.*, 1949).

ODONTOSCHISMA (Dum.) Dum.

O. SPHAGNI (Dicks.) Dum., sphagnum bogs, rare. V.-c. 16, Keston Common bog; R.A.B. V.-c. 20, Colney Heath; *Tr. H.*, 1893.

O. DENUDATUM (Mart.) Dum., peaty banks, etc., rare. V.-c. 17, Oxshott; Boxhill; E.C.W.

SCAPANIACEAE

DIPLOPHYLLUM Dum.

D. ALBICANS (L.) Dum., common on all non-calcareous soils. V.-c. 16, Joyden's Wood; Keston Common; Petts Wood; St. Paul's Cray Common; F.R. V.-c. 17, Oxshott; R.A.B. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 20, Bricket Wood; Wormley Wood; Northaw; *Tr. H.*, 1893; Bishops Wood; Hoddesdon Park Wood; near Whippendell Wood; T.D.V.S. V.-c. 21, Ruislip Woods; Stanmore and Harrow Weald Commons, 1927; P.W.R.; Ken Wood; R.A.B. V.-c. 24, Black Park; R.A.B.

SCAPANIA (Dum.) Dum.

S. CURTA (Mart.) Dum., woods and banks, rare. V.-c. 20, Bayford Wood, 1956; T.D.V.S. V.-c. 21, Ruislip Woods; *L.N.*, 1949.

S. IRRIGUA (Nees) Dum., marshy ground, damp woods, etc., not common. V.-c. 20, Bricket Wood; *Tr. H.*, 1917; Bencroft Wood; Bayford Wood; Millwards Park; Danemead Wood; T.D.V.S. V.-c. 21, Stanmore and Harrow Weald Commons, 1927; P.W.R.; Park Wood, Ruislip; R.A.B.

S. ASPERA Bernet, chalk grassland, rare. V.-c. 17, Boxhill; J.H.G.P.; corner of Headley Heath; F.R.

S. NEMOROSA (L.) Dum., banks in woods, etc., not common. V.-c. 16, Holwood Park; F.R.; Joyden's Wood; R.A.B. V.-c. 20, Bricket Wood; Hertford Heath; Boxwood; Wormley; *Tr. H.*, 1893; Hoddesdon Park Wood; J.H.G.P.; Bayford Wood; Bencroft Wood; Broxbourne Wood; Bishops Wood; Spital Brook Valley; T.D.V.S. V.-c. 21, Ruislip Woods; J.H.G.P.

S. UNDULATA (L.) Dum., rocks in streams, etc., rare. V.-c. 18, Thorndon Park, Brentwood, 1959; E.S. V.-c. 20, Wormley Wood; Hertford Heath; *Tr. H.*, 1893. V.-c. 21, Park Wood, Ruislip; R.A.B.

RADULACEAE

RADULA Dum.

R. COMPLANATA (L.) Dum., tree trunks and branches, rare. V.-c. 16, Hollows Wood; F.R. V.-c. 17, Bookham Common; C.P.C.; Fetcham; A.H.N.; Mickleham Downs; Boxhill; C.P.C. V.-c. 20, A common near Hertford; St. Albans; *Tr. H.*, 1893.

PORELLACEAE

PORELLA L. (MADOTHECA Dum.)

P. LAEVIGATA (Schrad.) Lindb., chalk soil, rare. V.-c. 17, Boxhill; E.C.W.

P. PLATYPHYLLA (L.) Lindb., walls and ground in chalk areas, common. V.-c. 16, Shoreham; J.H.G.P.; Downe; Eynsford; F.R. V.-c. 17, Limpsfield; Mickleham; Norbury Park; C.P.C.; Headley Lane; R.A.B.; Boxhill; Leatherhead; Woldingham; J.H.G.P. V.-c. 20, St. Albans; Panshanger Park; Hertford; *Tr. H.*, 1893; near Brookmans Park; T.D.V.S. V.-c. 21, Harefield; *L.N.*, 1949.

LEJEUNACEAE

LEJEUNEA Lib.

L. CAVIFOLIA (Ehrh.) Lindb., moist shady places, rare. V.-c. 16, Hollows Wood; F.R. V.-c. 17, Boxhill; E.C.W. V.-c. 20, Box Wood; Wormley Wood; Panshanger; Hertingfordbury; *Tr. H.*, 1893.

L. ULICINA (Tayl.) Tayl. (*MICROLEJEUNEA ULICINA* Evans), on trees, mainly on the chalk. V.-c. 17, Boxhill; C.P.C.; Mickleham; E.C.W.

COLOLEJEUNEA (Spr.) Schiffn.

C. MINUTISSIMA (Sm.) Schiffn., on trees, very rare. V.-c. 17, Headley Lane, on maple; *L.N.*, 1949.

FRULLANIA Raddi

F. TAMARISCI (L.) Dum., on trees, rare. V.-c. 17, among *Cornus* scrub on Boxhill; E.C.W. V.-c. 20, Wormley Wood; *Tr. H.*, 1893.

F. DILATATA (L.) Dum., on trees, more common in the south of the area than the north. V.-c. 16, Downe; F.R. V.-c. 17, Boxhill; J.H.G.P.; Walton Heath; E.C.W.; Bookham Common; Fetcham Downs; Limpsfield Common; Norbury Park; C.P.C. V.-c. 20, a common near Hertford; St. Albans; *Tr. H.*, 1893; Wormley Woods; E.C.W. and J.H.G.P.; Poplars Green; T.D.V.S.

MUSCI

SPHAGNALES

SPHAGNACEAE

SPHAGNUM Linn.

S. PALUSTRE Linn. (*S. CYMBIFOLIUM* Ehrh.) bogs, wet heaths, not uncommon. V.-c. 16, Keston; J.H.G.P. V.-c. 17, Wimbledon Common, 1934; C.A. V.-c. 18, Epping Forest; F.R. V.-c. 20, Little Berkhamsted; *Tr. H.*, 1893; Hoddesdon Woods; J.H.G.P.; Bishops Wood; Millwards Park; Oxhey Wood; T.D.V.S.

S. COMPACTUM DC (*S. RIGIDUM* Schp.) damp heaths, rare. V.-c. 17, Wimbledon Common; C.A.; Oxshott; J.H.G.P. V.-c. 21, Ruislip, 1927; P.W.R.

S. TERES (Schp.) Angstr., bogs, rare. V.-c. 17, Wimbledon Common, 1930; C.P.C., det. W. R. Sherrin.

S. SQUARROSUM Pers. ex Crome, wet heaths, rare. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 19, Epping Forest; E.S.

S. RECURVUM P. Beauv. (*S. INTERMEDIUM* Hoffm.), usually submerged, rare. V.-c. 17, Wimbledon Common, 1930; C.P.C. V.-c. 18, Epping Forest; F.R. V.-c. 19, Epping Forest; E.S. V.-c. 20, Bricket Wood; T.D.V.S.

S. PULCHRUM (Lindb.) Warnst. (*S. INTERMEDIUM* Hoffm. *var.* *PULCHRUM* Lindb. ex Braithw.), bogs, rare. V.-c. 16, Keston bog; F.R. V.-c. 18, Epping Forest; F.R.

S. CUSPIDATUM Ehrh. ex Hoffm. emend., pools and wet hollows, rare. V.-c. 16, Keston bog, 1924; D.G. Catcheside. V.-c. 17, Wimbledon Common, 1932; C.A. V.-c. 18, Epping Forest, 1951; F.R.

S. SUBSECUNDUM Nees (including *S. CRASSICLADUM* Warnst. and *S. OBESUM* Wils.), bogs and wet places, not uncommon. V.-c. 16, Keston; W. R. Sherrin. V.-c. 17, Oxshott, 1940; J.H.G.P.; Wimbledon Common; C.P.C. V.-c. 20, Bricket Wood; Berry Grove Wood; Hertford Heath; *Tr. H.*, 1884. V.-c. 21, Stanmore and Harrow Weald Commons, 1927; P.W.R.

var. *INUNDATUM* (Russ.) C. Jens. emend. Åberg, bogs, rare. V.-c. 16, Keston bog, 1940; J.H.G.P.

var. *BAVARICUM* (Warnst.) emend. Åberg., bogs, rare. V.-c. 17, Wimbledon Common, 1931; C.A.

var. *AURICULATUM* (Schp.) Lindb. emend. Åberg, bogs, etc., rare. V.-c. 18, Epping Forest, 1941; J.H.G.P. V.-c. 20, Bishops Wood; Bricket Wood, 1956; T.D.V.S. V.-c. 21, Stanmore and Harrow Weald Commons, 1927; P.W.R.; Whitewebbs Park, Enfield, 1939; J.H.G.P.

S. FIMBRIATUM Wils., by ponds, wet hollows, etc., not common. V.-c. 18, Wanstead Flats, Leytonstone, 1940; Epping Forest, 1956; J.H.G.P. V.-c. 20, Redwell Wood; Bricket Wood, 1956; T.D.V.S.

S. NEMOREUM Scop. (*S. ACUTIFOLIUM* Ehrh.), wet heaths, etc., rare., V.-c. 18, Epping Forest; *E.N.* 20. V.-c. 21, West Heath, Hampstead 1916; C.H.A.

S. PLUMULOSUM Röhl. (*S. ACUTIFOLIUM* Ehrh. *var.* *SUBNITENS* (Russ. and Warnst.) Dix.), wet heaths, rare. V.-c. 20, Bishops Wood, 1956; T.D.V.S.

BRYALES

POLYTRICHALES

POLYTRICHACEAE

ATRICHUM P. Beauv. (*CATHARINEA* Ehrh.)

A. UNDULATUM (Hedw.) P. Beauv. (*C. UNDULATA* Web. & Mohr), on the ground chiefly in woods. Very common throughout the area.

POLYTRICHUM Hedw.

P. NANUM Hedw., sandy banks, rare. V.-c. 17, Limpsfield Common, 1940; J.H.G.P.; Walton Heath; Esher; E.C.W.; Epsom Common, 1943; Headley Heath, 1946; E.F.W. V.-c. 20, Watford; Hertford Heath; *Tr. H.*, 1884; Broxbourne Bury, 1956; T.D.V.S.

P. ALOIDES Hedw., gravelly soil, sand pits, not common. V.-c. 17, Limpsfield Common, 1939; J.H.G.P.; Reigate; E.C.W.; Bookham Common, 1948; C.P.C. V.-c. 18, Epping Forest; E.N. 20. V.-c. 20, Westfields, St. Albans; Bricket Wood; Tunnel Woods, Watford; Broxbourne Wood; Hertford; *Tr. H.*, 1884 and 1885.

P. PILIFERUM Hedw., sandy heaths, common. V.-c. 17, Wimbledon Common; C.A.; Limpsfield Common; J.H.G.P. V.-c. 18, Epping Forest; Brentwood; J.H.G.P. V.-c. 20, Hertford Heath; *Tr. H.*, 1884; Broxbourne and Wormley Woods; Woods near South Mimms; E.C.W. and J.H.G.P. V.-c. 21, Northwest Heath, Hampstead, 1916; C.H.A.

P. JUNIPERINUM Hedw., sandy heaths, widespread in such habitats throughout the area.

P. GRACILE Sm., Woods, rare. V.-c. 18, Epping Forest, 1959; E.S. and R.M.P. V.-c. 19, Wintry Wood, Epping, 1947; J.H.G.P.

P. FORMOSUM Hedw., woods and heaths, abundant in all suitable habitats throughout the area.

P. COMMUNE Hedw., wet and boggy soils, often associated with *Sphagnum*, common. V.-c. 16, Keston bog; J.H.G.P. V.-c. 17, Esher Common; J.H.G.P.; Richmond Park; J.F.; "Common throughout the county"; E.C.W. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 20, Watford; Hertford Heath; *Tr. H.*, 1884; Bencroft Wood; Millwards Park; Redwell Wood; Oxhey Wood; Danemead Wood; Hawkshead Wood; Bishops Wood; T.D.V.S. V.-c. 21, Ruislip Woods; Stanmore and Harrow Weald Commons, 1927; P.W.R.; West Heath, Hampstead, 1916; C.H.A. V.-c. 24, Black Park; J.H.G.P.

FISSIDENTALES

FISSIDENTACEAE

FISSIDENS Hedw.

F. VIRIDULUS (Web. and Mohr.) Wahl., clay banks, etc., rare. V.-c. 17, Boxhill, 1946; A.H.N.; Norbury Park, 1950; C.P.C. V.-c. 20, near Bull's Mill, Hertford; *Tr. H.*, 1893.

F. MINUTULUS Sull. ex Braithw., chalky places, not common. V.-c. 17, Boxhill, 1948; E.C.W. V.-c. 18, Grays chalk pit, on bricks, 1959; E.S.

F. BRYOIDES Hedw., ditches, banks of streams, wet places in woods, abundant throughout the area.

F. INCURVUS Starke ex Web. and Mohr, clay banks, not common. V.-c. 17, Epsom, 1945; E.F.W.; Woldingham; W. R. Sherrin. V.-c. 19, Upshire, 1960; E.S. V.-c. 20. Brickendon Lane, Hertford; *Tr. H.*, 1894.

F. CRASSIPES Wils., on bricks, cement, etc., at sides of rivers, rare. V.-c. 19 and 20, Fishers Green, 1959; E.S. V.-c. 21, near Penton Hook; Grand Junction Canal, Harefield, 1927; P.W.R.; in iron pipe by River Lea, Hackney, 1939; J.H.G.P.

F. EXILIS Hedw., ditch and stream sides, muddy fields, etc., rare. V.-c. 17, Bookham Common, 1948; C.P.C. V.-c. 18, Epping Forest, 1939; J.R. and J.H.G.P. V.-c. 20, Broxbourne Wood, 1956; T.D.V.S.

F. TAXIFOLIUS Hedw., ditch and stream sides, among wet grass, etc., abundant throughout the area.

F. CRISTATUS Wils. (*F. DECIPIENS* DeNot.), in turf on chalk, common in suitable habitats. V.-c. 17, "common in turf on chalk downs, also on flint walls"; E.C.W.

F. ADIANTHOIDES Hedw., marshes and on dry chalky soil, not common. V.-c. 17, Boxhill; E.C.W.; Banstead; C.P.C. V.-c. 18, Grays chalk pit; E.S. V.-c. 20, Hertford Heath; *Tr. H.*, 1884; North of Wormley Wood, 1956; T.D.V.S.

DICRANALES

ARCHIDIACEAE

ARCHIDIUM Brid.

A. ALTERNIFOLIUM (Hedw.) Schp., gravelly soil, not common. V.-c. 20, Spitalbrook valley; Bishops Wood, 1957; T.D.V.S.

DICRANACEAE

PLEURIDIUM Brid.

P. ACUMINATUM Lindb. (*P. SUBULATUM* of Dix. *Handb.*, not of Rabenh.), usually in short grass, common. V.-c. 17, Limpsfield Common; Bookham Common; Boxhill; J.H.G.P. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 20, Great Wood; Millwards Park; T.D.V.S.; Broxbourne and Wormley Woods; wood near South Mimms; E.C.W. and J.H.G.P. V.-c. 21, Highgate Golf Course, 1916, C.H.A.; Ruislip, 1927; P.W.R.

P. SUBULATUM (Hedw.) Lindb. (*P. ALTERNIFOLIUM* (Dicks.) Brid.), usually among grass, not common. V.-c. 19, Upshire; E.S. V.-c. 20, Spital Brook valley; T.D.V.S. V.-c. 21, Ruislip, 1927; Hendon, 1923; P.W.R.

DITRICHUM Hampe

D. FLEXICAULE (Schleich.) Hampe, chalky ground in turf, not common. V.-c. 17, "all along the chalk downs"; E.C.W.

CERATODON Brid.

C. PURPUREUS (Hedw.) Brid., bare ground, walls, heaths, burnt ground, gravel pits, etc.; one of our commonest species and very abundant throughout the area.

SELIGERIA B. and S.

S. PAUCIFOLIA (Dicks.) Carruth., on loose pieces of chalk, rare. V.-c. 17, Boxhill; J.H.G.P. V.-c. 20, Tunnel Woods, Watford; *Tr. H.*, 1884.

S. CALCAREA (Hedw.) B. and S., on chalk, rare. V.-c. 17, "scattered along the chalk downs but rare"; E.C.W. V.-c. 18, Grays chalk pit; E.S. V.-c. 20, near Little Berkhamsted; T.D.V.S.

PSEUDEPHEMERUM (Lindb.) Hagen

P. NITIDUM (Hedw.) C. Jens. (*PLEURIDIUM AXILLARE* (Dicks.) Lindb.), ditches, wet ground, etc., not uncommon. V.-c. 17, Esher Common, 1943; E.F.W.; Wimbledon Common; C.A. V.-c. 18, Epping Forest, 1939, J.H.G.P. V.-c. 19, Wintry Wood, Epping; J.H.G.P. V.-c. 20, Millwards Park; Spital Brook Valley; Little Berkhamsted; T.D.V.S.; Bedwell Park; Hertford Heath; *Tr. H.*, 1894; Hoddesdon Woods; J.H.G.P.

DICRANELLA Schp.

D. SCHREBERIANA (Hedw.) Dix. (*D. SCHREBERI* (Hedw.) Schp.), on clay and gravel, rare. V.-c. 16, Joyden's Wood, 1960; A.G.S. V.-c. 19, Upshire; E.S. V.-c. 20, Fishers Green; E.S.

D. VARIA (Hedw.) Schp., usually on chalk or chalky soil, frequent. V.-c. 17, Woldingham and other chalk pits; E.C.W. V.-c. 18, Grays chalk pit; Purfleet; E.S. V.-c. 20, Tunnel Woods, Watford; Panshanger Park; *Tr. H.*, 1884; north of Wormley Wood, 1956; T.D.V.S.

D. RUFESCENS (Sm.) Schp., on ground, rare. V.-c. 18, Monk Wood, Epping Forest, 1951; F.R.

D. CERVICULATA (Hedw.) Schp., boggy ground, not common. V.-c. 17, Wimbledon Common, 1931; C.A.; Oxshott Heath, 1943; E.F.W.; Esher Common, 1947; J.H.G.P. V.-c. 18, Epping Forest; E.S. V.-c. 20, Hertford Heath; T.D.V.S. V.-c. 24, Black Park; E.C.W.

D. HETEROMALLA (Hedw.) Schp., banks, ditches, ground in woods, rabbit holes, etc., abundant throughout the area.

* *DICRANOWEISSIA* Lindb.

D. CIRRATA (Hedw.) Lindb., on tree trunks and branches, fences, etc., common in suitable places throughout the area.

DICRANUM Hedw.

D. MONTANUM Hedw., stumps and living trees, not common. V.-c. 20, Bishops Wood; Redwell Wood; Hoddesdon Park Wood; Box Wood; Danemead Wood; Oxhey Woods; T.D.V.S. V.-c. 21, Ruislip Woods; J.H.G.P. V.-c. 24, Black Park; E.C.W.

D. FLAGELLARE Hedw., on tree stumps and base of live oaks, not common. V.-c. 20, Hoddesdon Park Wood; J.H.G.P.; Wormley Wood; T.D.V.S. V.-c. 21, Ruislip Woods; J.H.G.P.

D. STRICTUM Schleich., on tree stumps, not common. V.-c. 17, Boxhill; E.C.W. V.-c. 20, Woods near South Mimms; E.C.W.; Hoddesdon Park Wood; Millwards Park; Danemead Wood (in profusion, 1956); T.D.V.S.

D. MAJUS Turn., banks in woods, uncommon. V.-c. 17, Limpsfield; Boxhill; E.C.W. V.-c. 18, Epping Forest, rare, 1938; W. R. Sherrin. V.-c. 20, Wormley Wood; R.A.B.; Hoddesdon Park Wood; T.D.V.S.

D. BONJEANI DeNot., in short turf and on ground in woods, common. V.-c. 17, Boxhill; Ashted Common; E.C.W.; Limpsfield Common; J.H.G.P.; Bookham Common; A.H.N. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 20, Hertford Heath; *Tr. H.*, 1884; Bishops Wood; Cowheath Wood; Hoddesdon Wood; T.D.V.S.

D. SCOPARIUM Hedw., on ground and tree stumps, common in woods throughout the area.

CAMPYLOPUS Brid.

C. PIRIFORMIS (Schultz) Brid., on ground in woods, common in woods throughout the area.

C. FLEXUOSUS (Hedw.) Brid., heaths and ground in woods, common. V.-c. 17, "common on heaths and in pinewoods"; E.C.W. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 20, Broxbourne and Wormley Woods; Woods near South Mimms; E.C.W. and J.H.G.P. V.-c. 21, North Grove, Highgate; C.H.A.; Stanmore and Harrow Weald Commons; 1927; P.W.R.

C. INTROFLEXUS (Hedw.) Brid., heaths, rare. V.-c. 24, near Black Park, 1959; E.C.W.

LEUCOBRYUM Hampe

L. GLAUCUM (Hedw.) Schp., on ground in woods, common. V.-c. 16, Abbey Wood; J.H.G.P. V.-c. 17, Esher Common; J.H.G.P. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 20, Wormley Wood; Berry Grove

Wood; Tunnel Woods, Watford; Bricket Wood, *Tr. H.*, 1884; Hoddesdon Wood; woods near South Mimms; J.H.G.P.; Bayford Wood; Great Wood; Hawkshead Wood; Bishops Wood; T.D.V.S.

POTTIALES

ENCALYPTACEAE

ENCALYPTA Hedw.

E. VULGARIS Hedw., calcareous ground, rare. V.-c. 17, Banstead Downs; Boxhill; E.C.W. V.-c. 20, Mead Lane, Hertford; *Tr. H.*, 1884. V.-c. 21, Hendon, 1922; P.W.R.

E. STREPTOCARPA Hedw., chalky banks and other calcareous places, not uncommon on the chalk. V.-c. 17, Boxhill; Norbury Park; Woldingham; J.H.G.P. V.-c. 20, Colney Heath (on bridge, 1956); T.D.V.S.

POTTIACEAE

TORTULA Hedw.

T. RURALIS (Hedw.) Crome, walls and roofs, not uncommon. V.-c. 17, Mickleham; Headley; Ballards near Croydon; E.C.W.; Boxhill; J.H.G.P. V.-c. 20, St. Albans; Watford; near Radlett; *Tr. H.*, 1884.

T. INTERMEDIA (Brid.) Berk., walls and concrete, frequent in chalky places. V.-c. 16, Betsham; J.H.G.P. V.-c. 17, Boxhill; Leatherhead; J.H.G.P. V.-c. 21; near Penton Hook; J.H.G.P.

T. LAEVIPIILA (Brid.) Schwaegr., on trees, etc., occasional. V.-c. 17, Bookham Common, on willow; J.H.G.P.; Boxhill; C.P.C. V.-c. 18, Grays chalk pit, on wooden sleepers; E.S. V.-c. 20, Panshanger Park *Tr. H.*, 1885.

T. LATIFOLIA (Bruch) Hartm. (*T. MUTICA* (Schultz) Lindb.), banks and tree trunks by streams, not uncommon. V.-c. 17, Norbury Park; E.C.W. V.-c. 18, Chigwell Lane by River Roding, 1943; J.H.G.P. V.-c. 19, Roydon; E.S. V.-c. 20, Terlings near Burnt Mill; J.H.G.P. V.-c. 21, near Penton Hook; J.H.G.P.

T. SUBULATA Hedw., on ground in woods, not common. V.-c. 17, Bookham Common, 1946; C.P.C.; Boxhill; J.H.G.P. V.-c. 20, near Colney Heath Church; Temple of Pan Woods, Watford; *Tr. H.*, 1884.

T. MURALIS Hedw., on walls, concrete, stonework, etc., abundant throughout the area even in Central London.

ALOINA Kindb.

A. RIGIDA (Hedw.) Kindb. (*TORTULA RIGIDA* (Hedw.) Schrad.), on banks, etc., rare. V.-c. 17, Epsom Downs, 1947; E.F.W. V.-c. 18, Grays chalk pit, 1959; E.S. V.-c. 20, Hertingfordbury Road, Hertford; *Tr. H.*, 1884.

A. AMBIGUA (B. and S.) Limpr. (*T. AMBIGUA* B. and S.), on banks, etc., rare. V.-c. 17, Epsom Downs, 1947; E.F.W.; Fetcham; C.P.C.

PTERYGONEURUM Jur.

P. OVATUM (Hedw.) Dix. (*TORTULA PUSILLA* (Hedw.) Mitt.), walls and banks, very rare. V.-c. 20, Hertingfordbury Road, Hertford; *Tr. H.*, 1894.

POTTIA Fuernr.

P. LANCEOLATA (Hedw.) C.M., banks, etc., rare. V.-c. 17, Reigate Heath, 1934; M. Saunders; Mickleham, 1946; C.P.C. V.-c. 20, near Gallows Plain, Hertford; *Tr. H.*, 1884.

P. TRUNCATA (Hedw.) Fuernr. (*P. TRUNCATULA* Lindb.), bare ground, fallow land, cart ruts, mole hills, etc., common in suitable habitats in all areas.

P. DAVALLIANA (Sm.) C. Jens. (*P. MINUTULA* (Schleich.) Fuernr.), chalk downs, fallow fields, etc., not uncommon. V.-c. 16, Shoreham; J.H.G.P. V.-c. 17, Caterham; E.C.W. V.-c. 20, Tunnel Woods, Watford; Gallows Plain, Hertford; *Tr. H.*, 1884. V.-c. 21, Ruislip, 1927; P.W.R.

P. STARKEANA (Hedw.) C.M., fallow fields, rare. V.-c. 17, Boxhill; J. A. Paton and E. V. Watson (per E.C.W.). V.-c. 20, between Cole Green and Essendon; *Tr. H.*, 1894.

P. BRYOIDES (Dicks.) Mitt., fallow fields, etc., rare. V.-c. 17, Woodcote Green, Epsom, 1944; E.F.W.

P. RECTA (Sm.) Mitt., chalky ground, uncommon. V.-c. 16, Shoreham; J.H.G.P. V.-c. 17, Boxhill; J.H.G.P.; Chipstead; E.C.W.

PHASCUM Hedw.

P. CURVICOLLUM Hedw., fallow fields, rare. V.-c. 17, Epsom Downs, 1947; E.F.W.; Boxhill, 1948; C.P.C.

P. CUSPIDATUM Hedw., fallow fields, cart ruts, etc., common. V.-c. 16, Shoreham; J.H.G.P. V.-c. 17, Bookham Common; J.H.G.P.; Cheam; E.C.W. V.-c. 18, Curtis Mill Green; J.H.G.P. V.-c. 20, Hertford; *Tr. H.*, 1884; Watford, 1925; A. Sutton. V.-c. 21, Hendon, 1922; P.W.R.

P. FLOERKEANUM Web. and Mohr, fallow fields, etc., rare. V.-c. 17, Headley Lane, Sept., 1946; E.F.W.

ACAULON C.M.

A. MUTICUM (Brid.) C.M., paths, gravel, etc., rare. V.-c. 17, Headley Heath, 1946; E.F.W. V.-c. 19, Upshire; E.S. V.-c. 20, Brickendon Fields; *Tr. H.*, 1894. V.-c. 21, Hendon, 1922; P.W.R.

CINCLIDOTUS P. Beauv.

C. FONTINALOIDES (Hedw.) P. Beauv., concrete river banks, not common. V.-c. 17, Barnes; Richmond; J.H.G.P. V.-c. 20, Grand Union Canal, Cassiobury; T.D.V.S. V.-c. 21, near Penton Hook; J.H.G.P.

C. MUCRONATUS (Brid.) Monk and Loeske (*C. BREBISSEANUS* (Fior. Mazz.) Husnot), river banks, not common. V.-c. 17, Esher; Mickleham; E.C.W.; Leatherhead; J.H.G.P.

BARBULA Hedw.

B. CONVOLUTA Hedw. paths, bare ground, walls, etc., very common throughout the area.

var. COMMUTATA (Jur.) Husnot (*B. CONVOLUTA* Hedw. *var. SARDOA* B. and S.), similar habitats, much less common. V.-c. 17, on Thames embankment at Kew and Richmond; E.C.W.; Limpsfield; Oxted; J.H.G.P.; Boxhill; E.F.W.

B. UNGUICULATA Hedw., paths, bare ground, walls, tree roots, etc., very common throughout the area.

B. REVOLUTA Brid., walls, rare. V.-c. 16, Farnborough, 1940; J.H.G.P. V.-c. 20, Watford; *Tr. H.*, 1884.

B. HORNSCHUCHIANA Schultz, ground, walls, etc., rare but possibly overlooked. V.-c. 17, Epsom Downs; Woodcote Green, Epsom, 1945; Ewell, 1946; E.F.W.

B. FALLAX Hedw., walls usually, not uncommon. V.-c. 17, Oxted; Boxhill; J.H.G.P.; Chessington; A.H.N.; Richmond Park, 1937; W. B. Turrill. V.-c. 18, Grays chalk pit; E.S. V.-c. 20, St. Albans; Radlett; Watford; Wormley Wood; *Tr. H.*, 1884. V.-c. 21, Shepperton, 1927; P.W.R.; Harefield, 1950; D.H.K.

B. RIGIDULA (Hedw.) Mitt., walls and roofs, not uncommon. V.-c. 17, Boxhill; Oxshott; J.H.G.P.

B. NICHOLSONI Culmann, concrete river banks, rare. V.-c. 17, Kew, 1936; C.A. V.-c. 21, near Penton Hook, 1922; P.W.R.; still there, 1947; J.H.G.P.

B. TRIFARIA (Hedw.) Mitt (*B. LURIDA* (Hornsch.) Lindb.), wet ground, rare. V.-c. 20, Tunnel Woods, Watford; *Tr. H.*, 1884.

B. TOPHACEA (Brid.) Mitt., wet ground, rare. V.-c. 17, Epsom Downs, 1947; E.F.W. V.-c. 19, Upshire; E.S.

B. CYLINDRICA (Tayl.) Schp., paths, etc., rare. V.-c. 17, Epsom, 1943; Epsom Common, 1944; E.F.W.

B. VINEALIS Brid., walls and rocks, not common. V.-c. 16, Betsham; J.H.G.P. V.-c. 17, Wimbledon Common, 1935; C.A.; Woodcote, 1943; Epsom, 1945; E.F.W. V.-c. 18, High Beech, Epping Forest; J.H.G.P. V.-c. 21, near Penton Hook, 1927; P.W.R.

B. RECURVIROSTRIS (Hedw.) Dix. (*B. RUBELLA* (Hoffm.) Lindb.), tree trunks, earthy banks, locally common. V.-c. 17, "common all along the chalk downs"; E.C.W.; Limpsfield; Chipstead; J.H.G.P.; Richmond Park, 1934; C.A. V.-c. 18, High Beech, Epping Forest, 1938; J.H.G.P. V.-c. 20, Panshanger Park; near Birch Green; *Tr. H.*, 1885. V.-c. 21, South Mimms; Shepperton, 1927; P.W.R.

TORTELLA (C.M.) Limpr.

T. TORTUOSA (Hedw.) Limpr. (*TRICHOSTOMUM TORTUOSUM* (Hedw.) Dix.), chalky ground, rare. V.-c. 17, Boxhill; J.H.G.P.

T. NITIDA (Lindb.) Broth. (*TRICHOSTOMUM NITIDUM* (Lindb.) Schp.), on stone, very rare. V.-c. 20. near Brookman's Park, 1956, on masonry by pond, "probably imported to Herts on the stone"; T.D.V.S.

T. INCLINATA (Hedw. fil.) Limpr. (*TRICHOSTOMUM INCLINATUM* (Hedw. fil.) Dix.), calcareous banks, very rare. V.-c. 17, Epsom Downs, 1945; E.F.W.

T. INFLEXA (Bruch) Broth., on lumps of chalk, rare. V.-c. 17, Boxhill; E.C.W. and F.R.

PLEUROCHAETE Lindb.

P. SQUARROSA (Brid.) Lindb., in chalk turf, rare. V.-c. 17, Boxhill; J.H.G.P.

TRICHOSTOMUM Bruch

T. SINUOSUM (Wils.) Lindb. (*BARBULA SINUOSA* Wils.) walls, stone, tree roots, not common. V.-c. 17, Gatton; Boxhill; E.C.W.; Headley Heath, 1946; E.F.W. V.-c. 19, Cobbins Brook near Upshire; E.S. V.-c. 20, Langleybury; T.D.V.S. V.-c. 20 and 21, Garrett Wood, Springwell, 1950; D.H.K. V.-c. 21, Penton Hook, 1927; P.W.R.

T. CRISPULUM Bruch, common on chalky ground. V.-c. 17, Boxhill; Woldingham; J.H.G.P.

WEISSIA Hedw.

W. CONTROVERSA Hedw. (*W. VIRIDULA* Hedw.) on the ground, not common. V.-c. 17, Boxhill; J.H.G.P. V.-c. 19, Upshire; E.S. V.-c. 20, Tunnel Woods, Watford; Hertingfordbury; *Tr. H.*, 1884 and 1896.

W. MICROSTOMA (Hedw.) C.M., chalky ground, not common. V.-c. 17, Coulsdon; E.C.W.; Boxhill; J.H.G.P.; Epsom Downs; E.F.W.

W. CRISPA (Hedw.) Mitt., chalky ground and gravel, rare. V.-c. 17, Boxhill; Woldingham; J.H.G.P. V.-c. 19, Upshire; E.S.

var. ACICULATA (Mitt.) Braithw., on ground, very rare. V.-c. 17, Cheam, 1926; E.C.W.

LEPTODONTIUM Hampe

L. FLEXIFOLIUM (Sm.) Hampe, on ground, very rare. V.-c. 17, Wimbledon Common, 1950; E.C.W.

L. GEMMASCENS (Mitt.) Braithw., on thatch, very rare. V.-c. 20, Bayfordbury, 1908; A. B. Jackson (*J. Bot.*, Vol. 46, p. 58).

GRIMMIALES

GRIMMIACEAE

GRIMMIA HEDW.

G. APOCARPA Hedw., walls and stone, not common. V.-c. 17, Bookham Station wall, 1946; A.H.N.; Mickleham, 1946, C.P.C. V.-c. 19, Roydon Churchyard, 1959; E.S. V.-c. 20, Panshanger Park; *Tr. H.*, 1884.

G. PULVINATA (Hedw.) Sm., walls and stonework, common. V.-c. 16, Shoreham; J.H.G.P. V.-c. 17, Limpsfield Common; Boxhill; J.H.G.P.; Bookham Common, 1942; C.P.C. V.-c. 18, High Beech churchyard wall, Epping Forest; J.H.G.P. V.-c. 20, St. Albans; Watford; Hertford; *Tr. H.*, 1884. V.-c. 21, Ruislip; Harefield, 1927; P.W.R.

RHACOMITRIUM Brid.

R. HETEROSTICHUM (Hedw.) Brid., walls, very rare. V.-c. 17, Betchworth, 1943; E.C.W.

FUNARIALES

FUNARIACEAE

FUNARIA Hedw.

F. HYGROMETRICA Hedw., Heaths, cinder paths, burnt ground, bombed sites etc., abundant throughout the area.

PHYSCOMITRIUM Brid.

P. PYRIFORME (Hedw.) Brid., rough stony ground, rare. V.-c. 17, Mitcham, 1934; Bookham Common, 1936; C.P.C. V.-c. 19 and 20, Fishers Green, 1959; E.S. V.-c. 20, Tunnel Woods, Watford; Broad Oak End, Hertford; *Tr. H.*, 1884.

PHYSCOMITRELLA B. and S.

P. PATENS (Hedw.) B. and S., river banks, etc., rare. V.-c. 19, Roydon; Parndon; E.S. V.-c. 21, Penton Hook, 1926; near Edgwarebury, 1927; P.W.R.

EPHEMERACEAE

EPHEMERUM Hampe

E. RECURVIFOLIUM (Dicks.) Boul. on ground, rare. V.-c. 17, Boxhill, several years from 1958; E.C.W.

E. SERRATUM (Hedw.) Hampe, bare ground and short grass, rare. V.-c. 16, Fawkhams Green, 1957; A.G.S. V.-c. 17, Walton-on-the-Hill, 1946; E.F.W. V.-c. 20, Millwards Park; Spital Brook Valley; field by Danefield Wood; T.D.V.S.

TETRAPHIDALES TETRAPHIDACEAE

TETRAPHIS Hedw.

T. PELLUCIDA Hedw., stumps of trees, old logs, tree roots, etc., common. V.-c. 16, Abbey Wood; J.H.G.P. V.-c. 17, Limpsfield Common; Bookham Common; J.H.G.P. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 19, Epping Lower Forest; R.M.P. V.-c. 20, Bayford Wood; Great Wood; Millwards Park; Bishops Wood; Oxhey Woods; T.D.V.S.; Wormley Wood; Redwell Wood; J.H.G.P. V.-c. 21, Bishop Wood; Turners Wood; 1916; C.H.A. Hampstead Woods, 1927; P.W.R. Ruislip Woods; J.H.G.P. V.-c. 24, Black Park; J.H.G.P.

EUBRYALES BRYACEAE

ORTHODONTIUM Schwaegr.

O. LINEARE Schwaegr. (*O. GRACILE* (Wils.) Schwaegr. *var. HETEROCARPUM* W. Watson), tree stumps, dead logs, ground round rabbit holes, etc., locally common. V.-c. 17, near Headley Heath, 1947; E.F.W.; Boxhill; E.C.W. V.-c. 18, Epping Forest, 1945; J.H.G.P. (spreading rapidly since); V.-c. 19, Epping Lower Forest; R.M.P. V.-c. 20, Redwell Wood near South Mimms; E.C.W.; Bayford Wood; Millwards Park; Bricket Wood; T.D.V.S. V.-c. 24, Black Park; E.C.W.

LEPTOBRYUM Wils.

L. PYRIFORME (Hedw.) Wils., ditches, cart ruts, gravel pits, etc., not common. V.-c. 17, Epsom; E.C.W.; Limpsfield Common, 1940; J.H.G.P. V.-c. 18, Leytonstone, 1941, J.H.G.P.; City of London Cemetery, East Ham, 1960; R.M.P. V.-c. 19 and 20, Fishers Green, 1959; E.S. V.-c. 21, Hendon, 1927, P.W.R.; Highgate Golf Links, 1916; C.H.A.

POHLIA Hedw.

P. NUTANS (Hedw.) Lindb. (*WEBERA NUTANS* Hedw.), on ground in woods, on heaths and sandy banks, etc., very common in all suitable habitats throughout the area.

P. ANNOTINA (Hedw.) Leoske (*W. ANNOTINA* (Hedw.) Bruch), sandy ground, brick walls, heaths, not uncommon. V.-c. 16, Shoreham Farnborough; J.H.G.P. V.-c. 17, Walton Heath; E.C.W.; Limpsfield Common, 1937; C.P.C. V.-c. 18, Epping Forest; E.S. V.-c. 20, Broxbourne Woods; E.C.W. and J.H.G.P.

P. PROLIGERA Lindb. (*W. PROLIGERA* (Lindb.) Kindb.) sandy ground, rare. V.-c. 17, Wimbledon Common, 1933; C.A. V.-c. 18, Epping Forest; *E.N.*, 20.

P. ALBICANS (Wahl.) Lindb. (*W. ALBICANS* (Wahl.) Schp.), on ground, very rare. V.-c. 17, Bookham Common, 1945; C.P.C.

P. DELICATULA (Hedw.) Grout (*W. CARNEA* Schp.), sandy banks and walls, not common. V.-c. 17, Mitcham; Kew; E.C.W.; Norbury Park, 1943; J.H.G.P.; Bookham Common, 1943; E.F.W. V.-c. 18, Epping Forest, Monks Wood, 1960; E.S. V.-c. 20, Panshanger Park; *Tr. H.*, 1884; Wormley Wood; Millwards Park, 1956; T.D.V.S.; Fishers Green, 1959; E.S. V.-c. 21, Ruislip Woods, 1947; J.H.G.P.

BRYUM Hedw.

B. PALLENS (Brid.) Röhl, wet ground, rare. V.-c. 19 and 20, Fishers Green, 1959; E.S. V.-c. 21, Ruislip; Harefield, 1927; P.W.R.

B. PSEUDOTRIQUETRUM (Hedw.) Schwaegr., wet ground, not common. V.-c. 17, Kew; E.C.W.; Epsom Common, 1946; E.F.W. V.-c. 19 and 20, Fishers Green, 1959; E.S. (*var. BIMUM*). V.-c. 20, Hertford Heath; *Tr. H.*, 1884; marsh, north of Wormley Wood, 1956; T.D.V.S. V.-c. 21, Ruislip Woods, 1947; J.H.G.P.

B. AFFINE (Bruch) F. Schultz, walls, ground, etc. V.-c. 19 and 20, Fishers Green, 1959; E.S.

B. CAESPITICIUM Hedw., walls, banks, bare ground, bombed sites, etc., common in all districts throughout the area.

B. ARGENTEUM Hedw., walls, pavements, concrete, paths, etc., very abundant throughout the area even in Central London.

B. BICOLOR Dicks (**B. ATROPURPUREUM** Web. and Mohr), bare ground, heaths, banks, ditch sides, etc., common. V.-c. 16, Sidcup; J.H.G.P. V.-c. 17, Limpsfield Common; Purley; Woldingham; J.H.G.P.; Richmond Park; C.L.C.; Bookham Common; A.H.N.; Kew Gardens; Banstead Downs; Esher Common; E.C.W.; Epsom Common; Epsom Downs, 1943; E.F.W. V.-c. 18, ditch by Chigwell Lane Station; Epping Forest; Hainault Forest; Brentwood; J.H.G.P. V.-c. 20, Gravel pits, Watford; *Tr. H.*, 1884; Broxbourne and Wormley Woods; E.C.W. V.-c. 21, Ruislip, 1927; P.W.R.; Moorgate, bombed site, 1948; C.P.C.

B. ERYTHROCARPUM Schwaegr., grassy banks, ant and mole hills, etc., common. V.-c. 17, Banstead Downs; Ashted Common; E.C.W.; Richmond Park; C.L.C.; Limpsfield Common; Bookham Common; J.H.G.P. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 19 and 20, Fishers Green; E.S. V.-c. 20, Broxbourne Wood; E.C.W. and J.H.G.P. V.-c. 21, Harefield; J.H.G.P.; Ruislip Woods; F.E.W.; Moorgate, bombed site, 1947; C.P.C.

B. CAPILLARE Hedw., walls, banks, tree roots, etc., especially on the chalk, common. V.-c. 16, Shoreham; Betsham; J.H.G.P. V.-c. 17, "common throughout the county"; E.C.W. V.-c. 18, Epping Forest; Grays chalk pit; J.H.G.P. V.-c. 20, St. Albans; Watford; Radlett; Bayford; *Tr. H.*, 1884; Hoddesdon Woods; J.H.G.P. V.-c. 21, Ruislip Woods; Shepperton, 1927; P.W.R.; Harefield; near Penton Hook; J.H.G.P.

RHODOBRYUM (Schp.) Limpr.

R. ROSEUM (Hedw.) Limpr., on ground in woods, very rare. V.-c. 17, Fetcham Downs, 1948; C.P.C.; Boxhill; E.C.W. V.-c. 20, Bell Wood, Bayford; *Tr. H.*, 1884.

MNIACEAE

MNIUM Hedw.

M. HORNUM Hedw., on ground and tree roots in woods, abundant in all woods throughout the area except on chalk.

M. CUSPIDATUM Hedw., damp ground in woods, rare. V.-c. 16, Keston Common; W. R. Sherrin. V.-c. 17, bank of River Mole below Leatherhead, 1943; E.F.W. V.-c. 20, Bayford Wood; *Tr. H.*, 1884.

M. LONGIROSTRUM Brid. (**M. ROSTRATUM** Schrad.), on ground in woods, not common, V.-c. 17, Chessington; A.H.N.; Boxhill; J.H.G.P.; Wimbledon, 1953; C.P.C. V.-c. 18, Epping Forest, 1923; *E.N.* 20. V.-c. 19, Epping Lower Forest, 1960; R.M.P. V.-c. 20, Colney Heath; Bricket Wood; near Radlett; Watford; *Tr. H.*, 1884. Note: some of the early records for V.-c. 18 and 20 may have been the next species.

M. AFFINE Bland., ground and banks in woods, common. V.-c. 16, Abbey Wood; Farnborough; J.H.G.P. V.-c. 17, Bookham Common;

Limpsfield Common; Purley; Richmond; Kew; Boxhill; J.H.G.P. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 21, Stanmore and Harrow Weald Commons, 1927; P.W.R.

M. RUGICUM Laur. emend. Tuomikoski (*M. AFFINE* Bland *var. RUGICUM* (Laur.) B. and S.), ground in woods, rare. V.-c. 18, Epping Forest, 1923; *E.N.* 20. V.-c. 19, Copped Hall Green, 1959; E.S.

M. UNDULATUM Hedw., ground and banks in woods, common. V.-c. 16, Shoreham; J.H.G.P. V.-c. 17, Chessington; A.H.N.; Boxhill; Titsey; J.H.G.P. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 19, Wintry Wood, Epping; J.H.G.P. V.-c. 20, Cassiobury Park; Bayford Wood; Radlett; Berry Grove Woods; Tunnel Woods, Watford; *Tr. H.*, 1884; Woods near South Mimms; E.C.W.; Cowheath Wood, Hoddesdon; J.H.G.P. V.-c. 21, Queen's Wood, Highgate, 1916; C.H.A.; Hampstead Woods, 1927; P.W.R.

M. PUNCTATUM Hedw., ditches and ground in woods, common. V.-c. 16, Farnborough; J.H.G.P. V.-c. 17, Woodcote Park, Epsom; Mickleham; E.C.W.; Richmond; J.H.G.P. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 20, Cassiobury Park; Wormley Wood; Bayford Wood; *Tr. H.*, 1884; Hoddesdon Woods; J.H.G.P.; woods near South Mimms; E.C.W.

AULACOMNIACEAE

AULACOMNIUM Schwaegr.

A. PALUSTRE (Hedw.) Schwaegr., boggy ground usually with *Sphagnum*, Common. V.-c. 16, Keston bog; J.H.G.P. V.-c. 17, Esher Common; J.H.G.P.; Wimbledon Common, 1949; Bookham Common; C.P.C. V.-c. 18, Epping Forest; Hainault Forest; Wanstead Flats, Leytonstone; J.H.G.P. V.-c. 20, Broxbourne; Colney Heath; Bricket Wood; *Tr. H.*, 1884; Hoddesdon Wood; J.H.G.P.; Hertford Heath; Danemead Ride; T.D.V.S. V.-c. 21, West Heath, Hampstead, 1916; C.H.A.; Stanmore and Harrow Weald Commons, 1927; P.W.R.

A. ANDROGYNUM (Hedw.) Schwaegr., peaty banks, dead logs, stumps, etc., common. V.-c. 16, Farnborough; J.H.G.P. V.-c. 17, Banstead Heath; Oxshott Heath; Cheam; E.C.W.; Limpsfield Common; Boxhill; Purley; J.H.G.P. V.-c. 18, Epping Forest; Hainault Forest; Brentwood; J.H.G.P. V.-c. 19, Galley Hill Wood, 1959; R.M.P. V.-c. 20, Boxwood near Hertford; near Radlett; Broxbourne Woods; *Tr. H.*, 1884; "abundant in all woods, 1956"; T.D.V.S. V.-c. 21, North Grove, Highgate, 1916; C.H.A.; Stanmore Common, 1927; P.W.R.; Harefield; D.H.K.; Ruislip Woods; J.H.G.P. V.-c. 24, Black Park; J.H.G.P.

BARTRAMIACEAE

BARTRAMIA Hedw.

B. POMIFORMIS Hedw., roadside banks, not common. V.-c. 16, Darenth Wood, 1951, "very rare"; F.R. V.-c. 17, Limpsfield Common, 1939; J.H.G.P. V.-c. 18, Epping Forest, 1923; *E.N.* 20. V.-c. 20, St. Albans; Colney Heath; Temple of Pan Woods, Watford; Hertford Heath; *Tr. H.*, 1884; Hoddesdon, 1942; J.H.G.P.; near Whippendell Wood, 1957; T.D.V.S. V.-c. 21, Highgate Golf Links, 1915; C.H.A. V.-c. 24, Black Park, 1950; E.C.W.

PHILONOTIS Brid.

P. FONTANA (Hedw.) Brid., bogs and ditches, rare. V.-c. 17, Wimbledon Common; E.C.W. V.-c. 18, Epping Forest, 1959; P.C.H. V.-c.

20, Colney Heath; Little Berkhamsted; *Tr. H.*, 1884; Millwards Park, 1956; T.D.V.S.

P. CAESPITOSA Wils. ex Milde, very rare, V.-c. 17, Ham Cross pond margin, Richmond Park, 1934; C.P.C.

ISOBRYALES

ORTHOTRICHACEAE

ZYGODON Hook. and Tayl.

Z. VIRIDISSIMUS (Dicks.) R.Br., trees, stumps and walls, common in places. V.-c. 16, Shoreham; J.H.G.P. V.-c. 17, Chessington; A.H.N.; Boxhill; Bookham Common; Woldingham; J.H.G.P. V.-c. 18, Grays chalk pit; E.S. V.-c. 20, Bayford; *Tr. H.*, 1894. V.-c. 21, Harefield; D.H.K.

ORTHOTRICHUM Hedw.

O. ANOMALUM Hedw., stone walls, etc., not common. V.-c. 16, Shoreham; J.H.G.P. V.-c. 20, Bayfordbury Park; *Tr. H.*, 1884; by pond near Brookmans Park, 1956; T.D.V.S.

O. AFFINE Brid., on trees, rare. V.-c. 17, near Headley Church, 1946; E.F.W. V.-c. 20, Tunnel Woods, Watford; Panshanger Park; *Tr. H.*, 1884/5.

O. STRIATUM Hedw. (*O. LEIOCARPUM* B. and S.), on trees, rare. Tunnel Woods, Watford; *Tr. H.*, 1884.

O. LYELLII Hook. and Tayl., on trees, locally common. V.-c. 17, throughout the county—local on ash and oak; E.C.W.

O. TENELLUM Bruch, on trees, rare. V.-c. 17, near Headley Church, 1946, "one small tuft only"; E.F.W.

O. DIAPHANUM Brid., walls and trees, not uncommon. V.-c. 17, Reigate, wall, 1931; M. Saunders; Woldingham; J.H.G.P. V.-c. 18, Epping Forest, 1923; *E.N.* 20; Grays chalk pit; E.S. V.-c. 20, Hertford *Tr. H.*, 1884; Colney Heath; Bricket Wood; T.D.V.S. V.-c. 21, Shepperton, 1927; P.W.R.

ULOTA Brid.

U. CRISPA (Hedw.) Brid., on trees, rare. Box Wood near Hertford; Bricket Wood; *Tr. H.*, 1884.

FONTINALACEAE

FONTINALIS HEDW.

F. ANTIPYRETICA Hedw., attached to stones and roots on river and stream banks, not uncommon. V.-c. 17, Norbury Park, 1935; Fetcham, 1940; Wimbledon, 1953; C.P.C. V.-c. 18, River Lea, Chingford; Walthamstow Reservoirs; J.H.G.P.; Epping Forest, Wake Valley Pond, 1960; E.S. V.-c. 20, Elstree; Croxley Mills; River Lea near Hertford; *Tr. H.*, 1884. V.-c. 21, Ruislip; near Penton Hook; J.H.G.P.

CLIMACEACEAE

CLIMACIUM Web. and Mohr

C. DENDROIDES (Hedw.) Web. and Mohr, boggy places, rare. V.-c. 17, Mitcham Common, 1926; D. G. Catcheside (per E.C.W.). V.-c. 20, Bricket Wood; Panshanger; *Tr. H.*, 1884.

HEDWIGIACEAE

HEDWIGIA P. Beauv.

H. CILIATA (Hedw.) P. Beauv., rocks, etc., very rare. V.-c. 17, Mickleham, March, 1958, on roof of shed; D. H. Dalby (*Trans. B.B.S.* III, p. 774).

CRYPHAEACEAE

CRYPHAEA Mohr

C. HETEROMALLA (Hedw.) Mohr, on trees, rare. V.-c. 20, Panshanger Park; *Tr. H.*, 1884.

LEUCODONTACEAE

LEUCODON Schwaegr.

L. SCIUROIDES (Hedw.) Schwaegr., on trees, rare. V.-c. 20, Park Bury House; Colney Street; Cassiobury Park; *Tr. H.*, 1884.

NECKERACEAE

NECKERA Hedw.

N. CRISPA Hedw., chalky ground, rare. V.-c. 17, Boxhill; J.H.G.P.

N. PUMILA Hedw., trees, rare. V.-c. 17, Gatton; E.C.W.; Boxhill; J.H.G.P. V.-c. 20, Panshanger Park; Bayfordbury Park; *Tr. H.*, 1884.

N. COMPLANATA (Hedw.) Hüben, chalky soil, tree trunks, rocks, common in suitable habitats. V.-c. 16, Shoreham; J.H.G.P. V.-c. 17, Headley Heath; E.C.W.; Chessington; A.H.N.; Boxhill; Woldingham; J.H.G.P. V.-c. 20, Hertford; Panshanger Park; St. Albans; near Radlett; Tunnel Woods, Watford; *Tr. H.*, 1884; Millwards Park; Cowheath Wood, Hoddesdon; T.D.V.S.

HOMALIA (Brid.) B. & S.

H. TRICHOMANOIDES (Hedw.) B. and S., trees and banks by rivers, not common. V.-c. 17, Chessington; A.H.N.; Boxhill; E.C.W. V.-c. 20, St. Albans; Bricket Wood; Tunnel Woods, Watford; between Little Berkhamsted and Hertford; *Tr. H.*, 1884. Broxbourne and Wormley Woods; E.C.W. and J.H.G.P.

THAMNIUM B. and S.

T. ALOPECURUM (Hedw.) B. and S. (*POROTRICHUM ALOPECURUM* (Hedw.) Mitt.), banks in woods, local. V.-c. 17, Boxhill; J.H.G.P.; Norbury Park, 1953; C.P.C.; Kew, 1949; A.H.N. V.-c. 20, St. Albans; near Radlett; Tunnel Woods, Watford; Bayford Wood; Wormley Wood; *Tr. H.*, 1884; Moor Park, 1945, C.P.C.

HYPNOBRYALES

LESKEACEAE

LESKEA Hedw.

L. POLYCARPA Hedw., banks and tree roots by rivers, not common. V.-c. 17, R. Thames, Kew; R. Mole, Boxhill; E.C.W.; R. Mole, Leatherhead; E.F.W. V.-c. 18, R. Roding, Chigwell Lane; J.H.G.P. V.-c. 19, R. Stort, near Roydon; E.S. V.-c. 20, R. Lea near Roxford Farm; *Tr. H.*, 1892.

THUIDIACEAE

ANOMODON Hook. & Tayl.

A. VITICULOSUS (Hedw.) Hook. & Tayl. calcareous ground, not uncommon on the chalk. V.-c. 17, Chipstead; Mickleham Downs; E.C.W.; Boxhill; Woldingham; J.H.G.P. V.-c. 20, near Colney Street; Radlett; Tunnel Woods, Watford; Hertford; *Tr. H.*, 1884; Whippendell Wood; T.D.V.S.

THUIDIUM B. and S.

T. ABIETINUM (Brid.) B. and S., among grass, rare. V.-c. 20, Panshanger Park; *Tr. H.*, 1884.

T. HYSTRICOSUM Mitt., in chalky turf, rare. V.-c. 16, Shoreham; J.H.G.P. V.-c. 17, "common along escarpment of North Downs"; E.C.W.; Woodcote, 1943; E.F.W.

T. TAMARISCINUM (Hedw.) B. and S., on ground in woods and on heaths, common. V.-c. 17, Chessington; A.H.N.; Bookham Common; Boxhill; Purley; J.H.G.P. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 19, Wintry Wood, Epping; J.H.G.P. V.-c. 20, Cassiobury Park; Hertford Heath; St. Albans; Bricket Wood; Berry Grove Wood; *Tr. H.*, 1884; Hoddesdon Wood; J.H.G.P.; Woods near South Mimms; E.C.W. V.-c. 21, North Grove, Highgate, 1916; C.H.A.; Ruislip Woods; Stanmore and Harrow Weald Commons, 1927; P.W.R. Harefield chalk pit; J.H.G.P.

T. PHILIBERTI Limpr., chalky turf, rare. V.-c. 17, Reigate Hill; Boxhill; E.C.W.

HYPNACEAE

CRATONEURON (Sull.) Roth

C. FILICINUM (Hedw.) Roth (*AMBLYSTEGIUM FILICINUM* (Hedw.) DeNot.), banks and stone by rivers and streams, not uncommon. V.-c. 17, near Banstead; E.C.W.; Richmond to Kew; Oxted; J.H.G.P. V.-c. 20, Cassiobury Park; *Tr. H.*, 1884. V.-c. 21, banks of R. Thames near Shepperton; Grand Union Canal, Harefield, 1927; P.W.R.; canal at Uxbridge; J.H.G.P.

C. COMMUTATUM (Hedw.) Roth (*HYPNUM COMMUTATUM* Hedw.), stream banks, rare. V.-c. 20, Water End; *Tr. H.*, 1884.

CAMPYLUM (Sull.) Mitt.

C. STELLATUM (Hedw.) Lange and C. Jens. (*HYPNUM STELLATUM* Hedw.), marshy ground, not common. V.-c. 17, Woldingham; Burgh Heath; E.C.W. V.-c. 20, Little Berkhamsted; Brickendon Fields; *Tr. H.*, 1884/87; marsh north of Wormley Wood; T.D.V.S.

C. PROTENSUM (Brid.) Kindb. (*H. STELLATUM* Hedw. *var.* *PROTENSUM* (Brid.) Röhl.), chalky ground, rare. V.-c. 17, Buckland Hills, 1955; E.C.W. V.-c. 18, Grays chalk pit; E.S.

C. CHRYSOPHYLLUM (Brid.) Bryhn (*H. CHRYSOPHYLLUM* Brid.), chalky ground, frequent. V.-c. 17, Woldingham; Banstead; E.C.W. V.-c. 18, Grays chalk pit; J.H.G.P.

C. SOMMERFELTII (Myr.) Bryhn (*H. HISPIDULUM* Brid. *var.* *SOMMERFELTII* (Myr.) Dix.), tree roots, etc., in chalk districts, rare. V.-c. 17, Boxhill; Bookham; E.C.W.

LEPTODICTYUM (Schp.) Warnst.

L. RIPARIUM (Hedw.) Warnst. (*HYPNUM RIPARIUM* Hedw.), posts, tree roots, etc. at edge of water, common. V.-c. 17, Kew; E.C.W.; Richmond; Bookham Common; J.H.G.P.; Wimbledon Common; C.A. V.-c. 18, Epping Forest; Wanstead Park; J.H.G.P. V.-c. 19, Wintry Wood, Epping; J.H.G.P. V.-c. 20, Bayford; J.H.G.P.; Millwards Park; Bricket Wood; Danemead Wood; Broad Riding Wood; T.D.V.S. V.-c. 21, R. Lea, Hackney; near Penton Hook; J.H.G.P.; Regent's Park, 1920; Pegler, det. W.R.S.

HYGROAMBLYSTEGIUM Loeske

H. TENAX (Hedw.) Jennings (*AMBLYSTEGIUM IRRIGUUM* (Wils.) B. and S.), stones and concrete in water, rare. V.-c. 19, Fishers Green, 1959; E.S.

AMBLYSTEGIUM B. and S.

A. SERPENS (Hedw.) B. and S., on the ground, dead logs, stumps, etc., common throughout the area.

A. JURATZKANUM Schp., among grass, roots of trees, etc., rare. V.-c. 16, Betsham, 1940; J.H.G.P. V.-c. 17, Whitehill, Caterham; E.C.W.; Limpsfield Common, 1939; J.H.G.P.; Wimbledon Common, 1935; C.A.

A. VARIUM (Hedw.) Lindb., wet places, very rare. V.-c. 21, near Penton Hook, 1927; P.W.R.; Mill Hill, 1919; J. Blundell, det. W. R. Sherrin.

DREPANOCLADUS (C.M.) Roth

D. ADUNCUS (Hedw.) Warnst. (*HYPNUM ADUNCUM* Hedw.), marshy and boggy places, ditches, streamsides, etc., common. V.-c. 17, Mitcham; Woodcote, Epsom; E.C.W.; Richmond Park; C.L.C.; Chessington; A.H.N.; Bookham Common; Limpsfield Common; J.H.G.P. V.-c. 18, Leytonstone; J.H.G.P.; Epping Forest; F.R. V.-c. 20, Bricket Wood; Hertford; *Tr. H.*, 1884; Bayford Wood; Bricket Wood; Broad Riding Wood; T.D.V.S. V.-c. 21, Harefield; Staines Moor, 1907; W. R. Sherrin.

D. FLUITANS (Hedw.) Warnst. (*H. FLUITANS* Hedw.), boggy ground, lake and stream sides, etc., common. V.-c. 17, Headley Heath, 1946; E.F.W.; Wimbledon Common; W.R. Sherrin (per E.C.W.); Fetcham, 1952; C.P.C. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 19, Wintry Wood, Epping; J.H.G.P. V.-c. 20, Bricket Wood; *Tr. H.*, 1884; Rickmansworth; J.H.G.P.; Millwards Park; Hawkshead Wood; T.D.V.S. V.-c. 21, Stanmore and Harrow Weald Commons, 1927; P.W.R.

HYGROHYPNUM Lindb.

H. LURIDUM (Hedw.) Jennings (*HYPNUM PALUSTRE* Huds.), rocks and walls in and by rivers, etc., not common. V.-c. 17, R. Thames, Barnes to Richmond; E.C.W. V.-c. 19, Roydon; E.S.

ACROCLADIUM Mitt.

A. STRAMINEUM (Brid.) Richards and Wallace (*HYPNUM STRAMINEUM* Brid.), boggy places, rare. V.-c. 17, Wimbledon Common, 1932; C.A.; Oxshott Heath, 1960; E.C.W. V.-c. 18, Epping Forest, 1951; F.R. V.-c. 20, Hertford Heath; *Tr. H.*, 1884. V.-c. 21, West Heath, Hampstead, 1916; C.H.A.

A. CORDIFOLIUM (Hedw.) Richards and Wallace (*H. CORDIFOLIUM* Hedw.), bogs, marshes, edge of ponds, etc., not common. V.-c. 17, Mitcham Common; E.C.W. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 19, Wintry Wood, Epping; J.H.G.P. V.-c. 20, near Wormley West End; Broxbournebury; Bayford Wood; Pryors Wood, Hertford Heath; *Tr. H.*, 1884/87; Millwards Park; Broad Riding Wood; T.D.V.S. V.-c. 21, Ruislip Woods; Stanmore Common, 1927; P.W.R.

A. CUSPIDATUM (Hedw.) Lindb. (*H. CUSPIDATUM* Hedw.), among wet grass, streamsides, wet clayey commons, chalk downs, etc., very common in such habitats throughout the area.

ISOTHECIUM Brid.

I. MYURUM (Brid.) Brid. (*EURHYNCHIUM MYURUM* (Brid.) Dix.), trunks of trees, locally common. V.-c. 17, "scattered over the county"; E.C.W. V.-c. 20, Birch Green; Panshanger Park; Brickendon Lane; Broxbourne Woods; Bricket Wood; Berry Grove Wood; Boxwood near Hertford Heath; *Tr. H.*, 1884/92; Broxbourne Woods, 1950; E.C.W. and J.H.G.P.; Woods near South Mimms; E.C.W. V.-c. 21, Ruislip, 1927; P.W.R.

I. MYOSUROIDES Brid. (*E. MYOSUROIDES* (Brid.) Schp.), trunks of trees and stumps, common. V.-c. 17, "common on beech, etc., on the downs and on oaks in woods on greensand"; E.C.W.; Chessington; A.H.N.; Boxhill; J.H.G.P. V.-c. 18, Epping Forest, Honey Lane Quarters, 1961; R.M.P. V.-c. 20, Hoddesdon Woods; J.H.G.P.; Woods near South Mimms; E.C.W. V.-c. 21, Ruislip Woods; J.H.G.P.; Harefield; D.H.K.

I. STRIATULUM (Spruce) Kindb. (*E. STRIATULUM* (Spruce) B. and S.), fallen tree trunks, rare; V.-c. 17, Boxhill; E.C.W.

CAMPTOTHECIUM B. and S.

C. SERICEUM (Hedw.) Kindb., tree trunks and walls, common in suitable habitats throughout the area.

C. LUTESCENS (Hedw.) Brid., on the ground in chalky places, locally common. V.-c. 16, Shoreham; J.H.G.P. V.-c. 17, Boxhill; Oxted; J.H.G.P. V.-c. 20, Tunnel Wood, Watford; Little Munden; Panshanger Park; Hertford; Brickendon; *Tr. H.*, 1884/87.

BRACHYTHECIUM B. and S.

B. ALBICANS (Hedw.) B. and S., heaths and commons, short turf, etc., common. V.-c. 17, Bookham Common; Limpsfield Common; Purley; Esher Common; Woldingham; J.H.G.P. V.-c. 18, Epping Forest; Hainault Forest; J.H.G.P. V.-c. 20, Hoddesdon Wood; London Colney; Oxhey; J.H.G.P.; Danemead Wood; Bayford; Millwards Park; Little Berkhamsted; T.D.V.S. V.-c. 21, Whitewebbs Park, Enfield; J.H.G.P.

B. GLAREOSUM (Bruch) B. and S., very rare. V.-c. 17, Limpsfield Common, 1937; J.R.

B. MILDEANUM (Schp.) Milde (*B. SALEBROSUM* (Web. & Mohr) B. and S. *var. PALUSTRE* Schp.), damp fields, etc., rare. V.-c. 18, Purfleet; E.S.

B. RUTABULUM (Hedw.) B. and S., on ground in woods, tree roots, heaths, hedges, stream banks, walls, etc., very abundant throughout the area.

B. RIVULARE (Bruch) B. and S., bogs, streamsides, etc., not common. V.-c. 17, Richmond to Kew riverside; J.H.G.P.; Reigate Hill; E.C.W. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 20, Broad Riding Wood; T.D.V.S.

B. VELUTINUM (Hedw.) B. and S., tree roots, walls, stumps, etc., common throughout the area.

B. POPULEUM (Hedw.) B. and S., walls and sandy ground, rare. V.-c. 17, Great Bookham; E.C.W. V.-c. 21, Grand Junction Canal, Harefield, 1927; P.W.R.

B. PLUMOSUM (Hedw.) B. and S., rocks near water, rare. V.-c. 20, Plantation near Hertford workhouse; *Tr. H.*, 1884.

SCLEROPODIUM B. and S.

S. CAESPITOSUM (Wils.) B. and S. (*BRACHYTHECIUM CAESPITOSUM* (Wils.) Dix.) stony ground, tree roots, etc., rare. V.-c. 17, Reigate Hill; Gatton; E.C.W.; Richmond-Kew riverside; Leatherhead; J.H.G.P.

S. ILLECEBRUM (Hedw.) B. and S. (*B. ILLECEBRUM* (Hedw.) DeNot.), on the ground, rare. V.-c. 17, Woodcote Park, Epsom; E.C.W.; Norbury Park, 1941; C.P.C.

CIRRIPHYLLUM Grout

C. PILIFERUM (Hedw.) Grout (*EURHYNCHIUM PILIFERUM* (Hedw.) B. and S.), on the ground in woods, common. V.-c. 16, Betsham; J.H.G.P. V.-c. 17, Boxhill; Bookham Common; J.H.G.P. V.-c. 20, Panshanger Park; Hertford; Hertford Heath; St. Albans; near Radlett; Tunnel Woods, Watford; *Tr. H.*, 1884; Hoddesdon Woods; J.H.G.P.; Woods near South Mimms; E.C.W. V.-c. 21, Ruislip Woods, 1927; P.W.R.

C. CRASSINERVIUM (Tayl.) Loeske and Fleisch. (*E. CRASSINERVIUM* (Tayl.) B. and S.), logs, tree roots, chalky ground, common on the chalk. V.-c. 16, Shoreham; J.H.G.P. V.-c. 17, Titsey; Boxhill; Woldingham; J.H.G.P.; Leatherhead; A.H.N.

EURHYNCHIUM B. and S.

E. STRIATUM (Hedw.) Schp. emend. Stormer, on the ground in woods, common. V.-c. 17, Chessington; A.H.N.; Bookham Common; Boxhill; Leatherhead; J.H.G.P. V.-c. 18, Purfleet; J.H.G.P. V.-c. 20, Watford; Box Wood; St. Albans; Bricket Wood; Bury Grove Wood; Radlett; *Tr. H.*, 1884; Hoddesdon Woods; J.H.G.P.; Woods near South Mimms; E.C.W. V.-c. 21, Ruislip, 1927; P.W.R.

E. PRAELONGUM (Hedw.) Hobk., on the ground in woods, stumps, ditch sides, etc., abundant throughout the area.

E. SWARTZII (Turn.) Curn., as the last especially in chalky places, fairly common. V.-c. 16, Farnborough; J.H.G.P. V.-c. 17, Boxhill; J.H.G.P.; Ashted; Limpsfield Common; Bookham Common; Fetcham; Wimbledon; C.P.C. V.-c. 18, Epping Forest; Hainault Forest; J.H.G.P.; Grays chalk pit; E.S. V.-c. 20, Tunnel Woods, Watford; *Tr. H.*, 1884; Hoddesdon Woods; J.H.G.P. V.-c. 21, Ruislip Woods, Stanmore Common, Hendon, 1927; P.W.R.

E. SCHLEICHERI (Hedw. fil.) Lor. (*E. ABBREVIATUM* (Turn.) Schp), woods, rare. V.-c. 17, Gatton; E.C.W.; Headley, 1943; E.F.W.

E. RIPARIOIDES (Hedw.) Jennings (*E. RUSCIFORME* (Neck.) Milde), rocks, stones, walls, etc., by water, common. V.-c. 16, Shoreham; J.H.G.P. V.-c. 17, "common in streams"; E.C.W. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 19, River Stort, Roydon; J.H.G.P. V.-c. 20, St. Albans; Cassiobury Park; Watford; *Tr. H.*, 1884; Broxbourne and Wormley Woods; E.C.W. V.-c. 21, Highgate pond, 1916; C.H.A.

E. MURALE (Hedw.) Milde, rocks, stones, bare ground, not uncommon. V.-c. 17, Bookham Common; J.H.G.P. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 21, Hampstead Lane; by Highgate pond, 1916; C.H.A.

E. CONFERTUM (Dicks.) Milde, base of trees, stumps, etc., common. V.-c. 16, Farnborough; J.H.G.P. V.-c. 17, Chessington; A.H.N.; Limpsfield Common; Bookham; Boxhill; Richmond; J.H.G.P. V.-c. 18, Hainault Forest; Wanstead Park; Ilford; J.H.G.P. Epping Forest; C.P.C. V.-c. 19, Roydon; J.H.G.P.; Epping Forest, 1960; R.M.P. V.-c. 20, Tunnel Woods, Watford; Panshanger Park; *Tr. H.*,

1884; Hoddesdon Woods; J.H.G.P.; Bricket Wood, 1936; C.P.C. V.-c. 21, Harefield; J.H.G.P.

RHYNCHOSTEGIELLA Limpr.

R. PALLIDIROSTRA (A.Br.) Loeske (*EURHYNCHIUM PUMILUM* (Wils.) Schp.), banks, stony ground, etc., locally common. V.-c. 17, "common along the chalk downs"; E.C.W.; Wimbledon Common, 1934; C.A. V.-c. 18, Epping Forest; J.H.G.P. V.-c. 20, Tunnel Woods, Watford; Brickendon Lane; *Tr. H.*, 1884/87; Box Wood; T.D.V.S.

R. TENELLA (Dicks.) Limpr. (*E. TENELLUM* Dicks. Milde), walls, bare chalk, etc., locally common. V.-c. 17, "common on flint walls along the chalk"; E.C.W.; Boxhill; A.H.N.; Limpsfield Common; C.P.C. V.-c. 18, Epping Forest, High Beech church; Purfleet; J.H.G.P. V.-c. 19, Roydon churchyard; E.S.

ENTODON C.M.

E. ORTHOCARPUS (LaPyl.) Lindb. (*CYLINDROTHECIUM CONCINNUM* (DeNot.) Schp.), chalky turf, common on the chalk. V.-c. 17, Headley Heath and Park Downs, Banstead; E.C.W.; Boxhill; Oxted; J.H.G.P.

PSEUDOSCLEROPODIUM (Limpr.) Fleisch.

P. PURUM (Hedw.) Fleisch. (*BRACHYTHECIUM PURUM* (Hedw.) Dix.), in grass on chalky and heathy ground, common throughout the area.

PLEUROZIUM Mitt.

P. SCHREBERI (Brid.) Mitt. (*HYPNUM SCHREBERI* Brid.) sandy heaths, downland, open spaces in woods, etc., common throughout the area.

ISOPTERYGIUM Mitt.

I. SELIGERI (Brid.) Dix. (*PLAGIOTHECIUM SILESIACUM* (Seilig.) B. and S.) dead logs, etc., rare. V.-c. 17, Boxhill; E.C.W.; Norbury Park; D.C. Martingell (per E.C.W.).

I. DEPRESSUM (Bruch) Mitt. (*P. DEPRESSUM* (Bruch) Dix.), trees, rocks, etc., not common. V.-c. 17, Boxhill; A.H.N.; Norbury Park, 1953; C.P.C. V.-c. 20, near Langleybury; T.D.V.S.

I. ELEGANS (Hook.) Lindb. (*P. ELEGANS* (Hook.) Sull.), on the ground in woods, ditch banks, etc., common in suitable habitats throughout the area.

PLAGIOTHECIUM B. and S.

P. LATEBRICOLA (Wils.) B. and S., decaying wood, roots of ferns, etc., rare. V.-c. 17, near Godstone; E.C.W.; wood near Headley Church, 1946; E.F.W. V.-c. 20, Hoddesdon Park Wood; Danemead Wood; T.D.V.S. V.-c. 21, Ruislip, 1921; P.W.R.

P. DENTICULATUM (Hedw.) B. and S. (agg.), on ground in woods, ditch sides, very common throughout the area.

P. CURVIFOLIUM Schliep (*P. DENTICULATUM* (Hedw.) B. and S. *var. APTYCHUS* (Spruce) Dix.), on ground in woods, etc., common in places. V.-c. 18 and 19, Epping Forest; E.S.

P. SILVATICUM (Brid.) B. and S., banks in woods, among grass, etc., not uncommon. V.-c. 17, Wimbledon Common; Limpsfield Common; Norbury Park; C.P.C. V.-c. 18, Epping Forest; E.S.; Passingford Bridge; Highams Park; J.H.G.P. V.-c. 19, Epping Forest; E.S. V.-c. 21, Ruislip Woods; Hampstead Woods, 1927; P.W.R.

P. UNDULATUM (Hedw.) B. and S., on ground under trees (especially beech), not uncommon. V.-c. 17, Woodcote Park, Epsom; E.C.W.; Boxhill; J.H.G.P. V.-c. 18, Epping Forest; Hainault Forest; J.H.G.P. V.-c. 19, Wintry Wood, Epping; J.H.G.P. V.-c. 20, Panshanger Park; *Tr. H.*, 1892; Broxbourne Wood; J.H.G.P.; Danemead Wood; T.D.V.S.

HYPNUM Hedw.

H. CUPRESSIFORME Hedw., on ground under trees, tree roots, stumps, walls, etc., abundant throughout the area.

var. RESUPINATUM (Wils.) Schp., on trees, common. V.-c. 16, Betsham; Shoreham; Farnborough; J.H.G.P. V.-c. 17, Boxhill; E.C.W.; Woldingham; Limpsfield Common; Bookham Common; J.H.G.P. V.-c. 18, Epping Forest; Hainault Forest; J.H.G.P. V.-c. 21, Whitewebbs Park, Enfield; J.H.G.P.

var. FILIFORME Brid., trunks of trees, local. V.-c. 17, Chessington; A.H.N.; Boxhill; J.H.G.P.

var. ERICETORUM B. and S., on heaths, common. V.-c. 17, Boxhill; Limpsfield; J.H.G.P. V.-c. 18, Epping Forest, 1923; *E.N.* 20. V.-c. 21, Stanmore and Harrow Weald Commons, 1927; P.W.R.; Ruislip Woods; J.H.G.P.

var. TECTORUM Brid., walls and roofs, occasional. V.-c. 17, Boxhill; Walton Heath; E.C.W.

H. PATIENTIAE Lindb., on ground among grass, rare. V.-c. 20, Bencroft Wood; wood at Little Berkhamsted, 1956; T.D.V.S.

CTENIDIUM (Schp.) Mitt.

C. MOLLUSCUM (Hedw.) Mitt. (*HYPNUM MOLLUSCUM* Hedw.) calcareous soil, locally common. Boxhill; Woldingham; Titsey; J.H.G.P.; "common all along the chalk downs"; E.C.W. V.-c. 20, Brickendon Fields; road to Brickendon near Clement; *Tr. H.*, 1885/87; Wormley Woods; E.C.W.

RHYTIDIADELPHUS (Lindb.) Warnst.

R. TRIQUETRUS (Hedw.) Warnst. (*HYLOCOMIUM TRIQUETRUM* (Hedw.) B. and S.), on the ground in calcareous places, locally common. V.-c. 17, "common all along the chalk downs"; E.C.W. V.-c. 20, St. Albans; Bricket Wood; Berry Grove Wood; Tunnel Woods, Watford; Box Wood; Brickendon Fields; *Tr. H.*, 1884/87.

R. SQUARROSUS (Hedw.) Warnst. (*H. SQUARROSUM* (Hedw.) B. and S.) among grass, hedgerows, etc., common in all parts of the area.

HYLOCOMIUM B. and S.

H. BREVIROSTRE (P. Beauv.) B. and S., woods, very rare. V.-c. 17, Boxhill; F.R. and E.C.W. V.-c. 20, Bricket Wood; *Tr. H.*, 1884.

H. SPLENDENS (Hedw.) B. and S., woods and heaths, not common in the area. V.-c. 17, Boxhill; J.H.G.P. V.-c. 20, St. Albans; Bricket Wood; Hertford Heath; Panshanger Park; Broxbourne Woods; *Tr. H.*, 1884/92. V.-c. 21, Ruislip Woods, 1927; (very rare). P.W.R.

The Survey of Bookham Common

NINETEENTH YEAR

Progress Report

THE Conservation Corps continued its work of scrub clearance in Central Plain in February, March and December. Lists have been made, with notes on their abundance, of the plants of the northernmost woodland areas (Kelseys and Stents Woods) for comparison with similar notes made in 1943 (C.P.C.).

BIRDS (G. Beven)

During the Spring of 1959 and again in 1960, a census was made of the

territories of singing males of certain birds in the sample of dense oakwood (Eastern Wood). The results are as follows, the figures following each species being the numbers of territories found in the 40 acres during 1959 and 1960 respectively:—

Robin 29, 23-24, Wren 13, 14-15, Blue Tit 10-11 16, Great Tit, 11, 12, Blackbird 9, 7, Chaffinch 2, 2-3, Willow Warbler 5, 2-3, Chiffchaff 2, 3. Comparison with previous results as given in the *London Naturalist*, No. 35, 1956, pp. 21-32, and No. 38, 1959, p. 58, indicates two interesting changes in the population of the woodland sample. The Chaffinches have slowly decreased in numbers since 1951 and remain at a low level, about one-quarter of the 1951 figure. The cause of this decrease is unknown but there has also been a slight decline in the population in the scrub and grassland, although this change is much less marked (*London Naturalist*, No. 39, 1960, p. 93). During the last two seasons there has been a considerable reduction in the Willow Warbler population. The numbers of Blue and Great Tits have, however, remained within their usual range.

Further studies are being made on the feeding niches on Western and Isle of Wight Plains in order to try to find out how the encroachment of scrub affects the feeding habits of the birds.

The Coot, *Fulica atra*, has been found breeding on the Isle of Wight pond. There was a pair present in 1954, 1958 and again in 1960. In each of these years young birds in down were seen. The Coot had been recorded previously, but with no mention of breeding (*L.N.* for 1943, p. 29).

MAMMALS (G. Beven)

During February, March and April, 1960, two Barn Owls, *Tyto alba*, roosted regularly in the scrubland, one on Bayfield Plain (ref. 7319) in a hawthorn covered with bracken and the other on Western Plain (ref. 4267) in a tall ivy-covered holly. Pellets were collected from both sites by Peter Harland and F. C. Reeves. These pellets were found to contain the bones shown in the following table. In order to estimate the proportion of the different animals in the owl's food, and to correct for their unequal size, a "conversion" factor has been used. This method was mentioned previously when recording the diet of the Tawny Owl, *Strix aluco*, in oakwood (*London Naturalist*, No. 38, 1959, p. 59). Barn Owls have usually been seen hunting over the plains of rough grassland which are now much overgrown by scrub. Field Voles, *Microtus agrestis*, were most frequent animals taken.

TABLE OF CONTENTS OF PELLETS OF BARN OWL

	Number of individuals	multiply by conversion factor	Prey Units	Per cent.
Pigmy Shrew, <i>Sorex minutus</i>	2	× 0.2	0.4	0.7
Common Shrew, <i>Sorex araneus</i>	4	× 0.5	2.0	3.2
Water Shrew, <i>Neomys fodiens</i>	1	× 0.75	0.75	1.2
Bank Vole, <i>Clethrionomys glareolus</i>	6	× 1.0	6.0	9.8
Field Vole, <i>Microtus agrestis</i>	46	× 1.0	46.0	75.4
Wood Mouse, <i>Apodemus sylvaticus</i>	4	× 1.0	4.0	6.5
Hedge Sparrow, <i>Prunella modularis</i>	2	× 1.0	2.0	3.2
Total	<u>65</u>		<u>61.15</u>	<u>100.0</u>

Thanks are due to J. Cooper for help with the identification of the bones.

The results of J. Lord's investigation, by trapping, of the population fluctuation and habitat specialization in the small mammals appear below.

Some Further Results of Trapping For Small Mammals at Bookham Common

By J. C. LORD

IN a recent issue of this journal Dr. J. L. Harrison (1956) discussed the results of a programme of trapping for small mammals which he had carried out during a period of leave from abroad. Four areas of the Common were trapped (one in Eastern Wood, two on Central Plain and one in the Hollows); at first, with a line of break-back traps spaced five metres apart and set for two days, and, later, with a line of Longworth traps spaced ten metres apart and prebaited for two or three days before being set. Though Harrison found that the two methods gave broadly comparable results, for any long-term study the use of live traps is bound to have a less deleterious effect ecologically. In view of this and the fact that the Longworth has become the standard trap for use in studies of this kind the second method has been adopted for the work described here.

Our knowledge of the population changes and habitat preferences of the different species of small mammal found in the British Isles stems largely from work done in a strictly limited number of localities. For some very extensive areas (including, apparently, South-East England) there is an almost complete dearth of corroborative information. Harrison's work represents one of the first attempts on the part of an amateur naturalist to obtain such information, and though, in the limited time available to him, he could not embark on any large-scale study he was able to show by simple statistical means that there was a denser population of *Apodemus sylvaticus*, the so-called Long-tailed Field-mouse, in woodland than in non-woodland areas. It was his demonstration that matters of this kind could be tackled with only limited resources of equipment and time that led the present writer to attempt the follow-up of Harrison's survey described here. While the main object of this has been to extend the inquiry to areas additional to those trapped by Harrison (and, if possible, more representative of the major types of habitat found on the Common), the main spur to it has been the hope that more information would be obtained on the habitat preferences of the various species present on the Common.

The writer lives within walking distance of Bookham and for two years university vacations enabled him to mount short but intensive trapping programmes at regular three-monthly intervals. The Easter Vacation and early part of the Long Vacation of 1958 were occupied with trial runs and in staking out trap lines. Thereafter, between September, 1958 and January, 1960, six trapping surveys were made:—

- Survey I 24 September—5 October, 1958
- II 30 December, 1958—12 January, 1959.
- III 30 March—14 April, 1959.
- IV 26 June—12 July, 1959.
- V 22 September—4 October, 1959.
- VI 20 December, 1959—2 January, 1960.

METHOD

The method employed departed from that of Harrison in one major particular: pre-baiting was omitted. Each morning for about a fortnight the traps were taken up, cleared and then reset at another site. Though prebaiting undoubtedly helps to overcome "trap-shyness" it is most unlikely to have an equal effect on even the four commonest species. And dispensing with it does at least eliminate the effects of the converse phenomenon of "trap-addiction". It was for similar reasons that each site was trapped only once in the course of each survey i.e. no more frequently than once in three months.

No special routine was followed in siting individual traps: they were set as near to the ten-metre mark as possible. In grassland this was done at the level of the vole "runways". For the more exposed of the woodland sites some cover was provided artificially where disturbance by Grey Squirrels or human beings was possible. The former were probably responsible for the overturning of one trap, the latter for the theft of another.

For Survey I and II the same number of traps were set as in Harrison's lines—fourteen; but the number of areas trapped was increased from four ((a) to (d) below) to eleven. They were:—

- (a) EASTERN WOOD (square 62 of Castell (1943); area I of Jones (1954)). The line was laid along a grassy path in damp oakwood with an upper scrub layer of hawthorn and hazel and a fairly open lower shrub layer of bracken and bramble.
- (b) CENTRAL PLAIN (SOUTH-EAST WOOD) (squares 85 and 86, area S). Three traps were set in damp oakwood, the remainder in *Deschampsia cespitosa* grassland much overgrown with bracken and with hawthorn and rose.
- (c) CENTRAL PLAIN (squares 84, 87 and 88; area R). The line ran north-west from the site of the footbridge across the Isle of Wight ditch through grassland of *Deschampsia cespitosa* with some *Molinia caerulea* and *Juncus* sp. Though bushes of rose and hawthorn were numerous the ground layer had not become overgrown.
- (d) HOLLOWS (squares 58 and 59; area N). The line was laid through the middle of Eastern Hollow, over the bank and into Western Hollow. The area is marshy and carries a luxuriant vegetation. To the east it opens out into a fairly extensive patch of *Deschampsia cespitosa* grassland.
- (e) BAYFIELD PLAIN (square 73; area Q). *Deschampsia cespitosa* grassland with scattered hawthorn bushes and patches of bramble.
- (f) ISLE OF WIGHT PLAIN (square 49; area P). The line was laid across a patch of dense bracken.
- (g) EASTERN PLAIN (squares 82 and 83; area T). The traps were set in a belt of *Molinia caerulea* bordered on either side by bracken.
- (h) CENTRAL WOOD (squares 53 and 56; area G). Damp oakwood, with much birch and hazel and a fairly open lower shrub layer of bracken and bramble.
- (i) STENTS WOOD (square 26; area B). Damp oakwood, with hazel and holly but virtually no lower shrub layer. Ground layer non-existent.
- (j) HILL HOUSE WOOD (squares 19 and 43; area D). Damp oakwood. Seven traps were laid in an area where sycamore was co-dominant and there was neither a lower shrub layer nor a ground layer. The

TABLE I

	<i>Clethrionomys gl.</i>										<i>Apodemus sylvaticus</i>										<i>Sorex araneus</i>										<i>Microtus agrestis</i>										<i>Total*</i>	<i>Trap N^os</i>
(i) GRASSLAND with thick vegetation	0	0	2	2	2	1	5	10	1	2	5	2	1	13	24	12	2	18	11	14	3	60	8	19	23	6	8	17	81	190	607											
(b) Central Plain	0	0	2	2	2	1	3	2	0	0	0	0	0	3	0	2	0	1	1	1	1	3	0	3	4	1	1	1	7	13	49											
(c) Central Plain	0	0	0	1	0	3	4	4	0	0	0	0	0	3	3	3	1	2	5	1	1	13	2	6	6	2	1	1	18	42	112											
(d) Hollows	0	0	0	1	0	0	1	1	0	2	1	2	1	6	12	3	0	6	3	6	1	19	1	2	0	0	3	5	11	43	112											
(e) Bayfield Plain	0	0	0	0	0	2	2	2	0	0	1	0	0	3	4	0	1	2	1	1	0	5	2	6	6	3	3	3	23	37	111											
(f) Isle of Wight Plain	0	0	0	0	0	1	0	1	1	0	2	0	0	0	3	1	0	1	0	2	1	5	1	1	5	1	0	5	13	25	111											
(g) Eastern Plain	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2	3	0	6	2	4	0	15	2	1	2	0	1	3	9	30	112											
	0	0	2	2	2	1	5	10	1	2	5	2	1	13	24	12	2	18	11	14	3	60	8	19	23	6	8	17	81	190												
(ii) CLEARINGS with dense ground cover	0	0	2	2	2	1	4	7	0	0	0	0	0	9	9	0	0	2	1	2	0	5	0	0	0	0	0	0	1	22	84											
(l) Central Wood	0	0	2	2	2	1	4	7	0	0	0	0	0	9	9	0	0	2	1	2	0	5	0	0	0	0	0	0	1	22	84											
(m) Woodland Path	0	0	1	1	1	1	1	1	0	1	1	1	1	9	11	0	1	1	1	1	1	1	0	0	0	0	0	0	0	3	21											
(n) Rydal Path	0	0	2	2	2	4	9	17	0	0	1	1	1	9	11	0	2	0	0	0	2	2	0	0	0	0	0	2	2	32	84											
(o) Central Wood	0	0	3	3	3	3	9	18	0	1	3	1	7	12	12	0	0	0	0	0	0	0	0	1	0	2	1	4	34	84												
	0	0	6	7	8	22	43	43	0	2	4	2	25	33	33	0	5	1	2	0	8	0	0	2	0	2	3	7	91	273												
(iii) WOODLAND with dense ground cover	2	2	2	2	2	5	6	19	0	2	3	6	1	10	22	0	2	1	0	0	0	3	0	0	0	0	0	0	0	45	112											
(a) Eastern Wood	2	2	2	2	2	5	6	19	0	2	3	6	1	10	22	0	2	1	0	0	0	3	0	0	0	0	0	0	0	29	112											
(b) Central Wood	0	0	1	5	2	7	15	15	0	0	1	0	0	7	8	2	0	3	0	1	0	6	0	0	0	0	0	0	0	27	70											
(f) Hill House Wood	2	0	7	0	1	4	14	14	1	0	1	0	3	6	11	1	0	1	0	0	2	2	0	0	0	0	0	0	0	8	48											
(k) Hill House Wood	2	0	5	0	0	0	0	7	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	342											
	6	2	15	7	8	17	55	55	1	2	6	6	4	23	42	3	2	5	0	1	0	11	0	0	0	0	0	0	0	109												
(iv) WOODLAND with sparse ground cover	0	1	1	2	0	2	6	6	1	4	1	6	9	10	31	0	1	0	0	0	0	1	0	0	0	0	0	0	0	38	112											
(j) Stents Wood	0	0	0	1	0	3	4	4	1	0	2	2	2	4	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	41											
(j) Hill House Wood	0	1	1	3	0	5	10	10	2	4	3	8	11	14	42	0	1	0	0	0	0	1	0	0	0	0	0	0	0	53	153											
	6	3	24	19	17	49	118	118	4	8	16	20	18	75	141	15	5	28	12	17	3	80	8	19	25	6	10	20	88	443	1375											

* All species.

remaining traps were set in grass in an area with an upper shrub layer of hawthorn and holly and a lower one of extensive bramble.

- (k) HILL HOUSE WOOD (square 51, area E). Three traps were laid in a grassy open space, the other eleven in damp oakwood with hawthorn and an open lower shrub layer of brambles.

Early in 1959 it was decided to attempt a comparison between trapping results for woodland clearings and those for the grassland and woodland trapped hitherto. Consequently, for Survey III, the traps were laid at four additional sites to obtain the data for this. The clearings chosen were:—

- (l) CENTRAL WOOD (square 56). The traps were laid along Tunnel Path, a broad track, on either side of its junction with Woodland Path (South). The bordering woodland was fairly open; later in the year it was to be even further cleared of timber.
- (m) WOODLAND PATH (SOUTH) (square 64). A broad grassy ride through typical damp oakwood.
- (n) RYDAL PATH (NORTH) (square 37). From its junction with High Point Path north east through the thinly-wooded and bracken-covered area known as Sheepbell Hollow.
- (o) CENTRAL WOOD (squares 28, 52 and 53; areas A and G). Two traps were laid to the north of High Point Path, the remainder in a luxuriantly bracken-covered area from which trees and bushes had been cleared.

For this and subsequent surveys the length of the trapping line was also increased by laying seven extra traps. In general, these were set in the same habitat as the other fourteen, though in (b) they were all on grassland, in (d) in Eastern Hollow, and in (g) in *Molinia caerulea* grassland completely overgrown with bracken.

For Surveys IV to VI this pattern of trapping was maintained with, however, one fewer area covered of grassland, woodland and woodland clearing. Trapping was discontinued at (c), (k), and (m).

Nest boxes were provided with dry hay or bracken and baited with carrot and coarse oatmeal. Animals found in the traps were taken out by hand and their species and sex determined. Marking was not attempted: in view of the time lag between surveys it was considered unlikely that it could yield much information. Measurements were made on corpses only. The animals most often found dead were the Common Shrews. The lengths of the head and body, the tail and the hind foot of these were recorded but not the weights. Live animals were invariably released near the spot where they had been caught. When fleas appeared in the course of handling, attempts were made to secure them for subsequent identification.

RESULTS

In 1,375 trap nights a total of 443 animals were caught. The breakdown of this total by species is as follows:

<i>Sorex araneus</i> Linn.	Common Shrew	80
<i>Sorex minutus</i> Linn.	Pygmy Shrew	9
<i>Neomys fodiens</i> Schreber	Water Shrew	3
<i>Clethrionomys glareolus</i> Schreber	Bank Vole	118
<i>Microtus agrestis</i> (Linn.)	Short-tailed Vole	88
<i>Apodemus sylvaticus</i> (Linn.)	Wood-Mouse (or Long-tailed Field-mouse)	141
<i>Micromys minutus</i> (Pallas)	Harvest Mouse	4

The four commonest species provide 96% of the catch. The trapping results for these four are summarized in Table 1: the number of animals caught in an area is given for each survey visit together with the total caught at that site of all species. For woodland sites these data are grouped according to the extent of ground vegetation, a distinction being made between those areas where it is sparse or non-existent and others where it is thick or dense. The results for woodland clearings are combined, and likewise those for grassland sites (including the Hollows). The Hollows, it is true, bear some resemblance to the clearings trapped elsewhere on the Common in being at least partially enclosed by woodland, but the vegetation, especially of the larger Eastern Hollow, more closely resembles that to be found on the Plains. As the table shows, the composition of the mammal population is also reasonably typical of a grassland site, with Short-tailed Voles and Common Shrews fairly frequent in the traps but not Bank Voles. The catch of Wood-Mice probably includes animals foraging from the bordering wood as well as members of a population centred on the marsh itself.

The results for the remaining three species are summarized more briefly in Table 2. Except for one of the Pygmy Shrews all these records are for grassland sites. The roman figures in brackets indicate the surveys during which these animals were caught.

TABLE 2

<i>Area</i>	<i>Sorex minutus</i>	<i>Neomys fodiens</i>	<i>Micromys minutus</i>
(a)	1 (VI)		
(b)	1 (I)		
(c)	2 (III, V)	2 (II)	
(e)	1 (II)	1 (VI)	1 (V)
(f)	2 (I, III)		1 (II)
(g)	2 (II, V)		2 (II)
<i>Total</i>	9	3	4

INTERPRETATION

The interpretation of trapping results is fraught with hazards, many of which have already been discussed by Dr. Harrison. It is, however, maintained by the present author that the complications due to differences in behaviour towards traps shown by animals of the same and of different species are to some extent lessened when prebaiting is omitted from the trapping procedure. If, as seems probable, "the main attractant to the traps is curiosity" it is needlessly complicating matters to subject the results to other imponderables by allowing "trap shyness" and "trap addiction" to affect the size and composition of catches made on subsequent nights.

One factor not discussed by Harrison is that of "pre-emption". The only claim that can be made for the trapping results from "one night stands" such as are described in this paper is that, to some extent, they provide indices of the size and composition of the actual population of small mammals.* Whatever validity this claim may have it is clearly

* Just to what extent this claim is justified is the object of further investigations at Bookham now in progress. Attempts are being made at "trapping-out" different areas by laying traps in grid patterns, using marking techniques and trapping each site for several nights in succession.

dependent on there being empty traps for prospective captures to explore. Ideally, there should be an infinite number of such traps available: in practice, it is assumed that the validity of the conclusions drawn from the results is seriously impaired only when the number of traps still open on collection falls below two-thirds of the total laid. This situation arose only once in the course of this investigation—as the following table shows

TABLE 3

Survey	I	II	III	IV	V	VI
Total no. of traps laid ..	154	154	311	252	252	252
Total no. of traps set off ..	39	43	100	60	66	153
Total no. remaining open ..	115	111	211	192	186	99
% remaining open ..	74.7	72.1	67.9	76.2	73.8	39.3

(The totals of traps “set off” include 17 for which the trip-mechanism was set off accidentally or from which animals escaped).

In the discussion which follows it will be assumed that the totals obtained for a species in Surveys I to V reflect the population level and also the proportion of the small mammal population (S.M.P.) made up of animals of that species. This may not be assumed for the results of Survey VI; for, at the time of that survey, the actual population of a species may well have been very much higher than is indicated from any comparison with the numbers caught during previous surveys and so no estimate is possible of the proportion of the S.M.P. made up of members of any of the various species present.

DISCUSSION

Examination, however cursory, of the trapping results given in Table 1 indicates that, for the period of this investigation at least, each of the four commonest species showed definite habitat preferences. This stands out even more clearly when these results are expressed in terms of the number of traps occupied for every hundred laid. The data for Table 4 have been calculated from the trapping results of Surveys I to V taken together: those for Survey VI are given separately in brackets.

TABLE 4

	GRASSLAND <i>with thick vegetation</i>	CLEARINGS <i>with dense ground cover</i>	WOODED AREAS <i>with dense ground cover</i>	<i>with sparse ground cover</i>
Total no. of “trap-nights”	502 (105)	210 (63)	286 (56)	125 (28)
<i>Microtus agrestis</i>	12.8 (16.2)	1.9 (4.8)	0.0 (0.0)	0.0 (0.0)
<i>Sorex araneus</i>	11.4 (2.9)	3.8 (0.0)	3.8 (0.0)	0.8 (0.0)
<i>Apodemus sylvaticus</i>	2.2 (12.4)	3.8 (39.7)	6.6 (41.1)	22.4 (50.0)
<i>Clethrionomys glareolus</i>	1.0 (4.8)	10.0 (34.9)	13.3 (30.4)	4.0 (17.9)
(Other species)	2.8 (1.0)	0.0 (0.0)	0.0 (1.8)	0.0 (0.0)
(All species)	30.1 (37.1)	19.5 (79.4)	23.8 (73.2)	27.2 (67.9)

Short-tailed Voles were found only on open grassland and in clearings, and a chi-squared test shows that in the S.M.P.s of these two types of habitat they made up a significantly greater proportion of that of open grassland. The size of the catch made during Survey VI does not differ significantly from that made during Survey II twelve months earlier.

Though small numbers of Common Shrews were caught in wooded areas this species was also found in significantly greater proportion in the S.M.P. of open grassland than in that of any other type of habitat. Here again, there was no significant difference between the numbers caught in January, 1959, and those caught in January, 1960.

Comment has already been made on the exceptional number of small mammals caught during Survey VI. A trebling of the catch of Wood-Mice accounted for much of the increase. Previously, though the Wood-Mouse had been found in all four types of habitat, the available evidence suggests that it had tended to predominate in wooded areas with sparse ground cover. Certainly this was the case in the summer and autumn of 1959: if the results of Surveys IV and V are taken together it is found that 19 out of the 22 animals caught in this type of habitat were of this species; whereas for wooded areas with dense cover the proportion was 10 out of 26, and for clearings 6 out of 26. For Survey VI, on the other hand, there is no significant difference between these three habitats as regards the proportion of the catch made up by Wood-Mice. However, the species remained less well represented on open grassland throughout the period of this investigation.

Like the Wood-Mouse, the Bank Vole proved to be much more numerous in woodland than on open grassland. And it, too, was caught in increased numbers during Survey VI. However, unlike the Wood-Mouse, it had all along been more numerous in clearings and in wooded areas with dense ground cover than in areas of sparse cover. The increased catch of Survey VI was largely confined to these two habitats. As in the case of the Wood-Mouse, the difference between these two types of habitat in the proportion of their S.M.P.s occupied by this species was not statistically significant.

Very little can be said about the habitat preferences of the other three species found in the course of this investigation since the total numbers involved are small. However, what evidence there is suggests that, at Bookham, all three are confined largely to open grassland.

SUMMARY

1. Fifteen areas of Bookham Common selected as representative of its major habitats were trapped, twelve of them for a year or more at regular three-monthly intervals.
2. Four hundred and forty-three animals were caught of seven species. Each of the four commonest of these showed definite habitat preferences. For Short-tailed Voles and Common Shrews the favoured habitat was open grassland. The population level of Bank Voles was greatest in wooded areas with dense ground cover and in woodland clearings; while that of Wood-Mice was greatest in wooded areas with only sparse ground cover.

ACKNOWLEDGMENTS

I should like to acknowledge my gratitude to the Mammal Society of the British Isles for the loan of Longworth traps; to H. N. Southern for the help and encouragement which enabled me to start this investigation; to Dr. R. M. Newson for patient instruction in the handling of small mammals; and to Dr. G. Beven for encouragement, advice and helpful discussion throughout. In addition, I am indebted to Dr. P. Crowcroft, Miss Jean Ingles and A. Murrells of Tollgate Farm, Effingham, for many kindnesses.

REFERENCES

- HARRISON, J. L., 1956, Some Small Mammals of Bookham Common. *Lond. Nat.*, 35, 12-20.
 CASTELL, C. P. C., 1943, Bookham Common : Some preliminary observations on the base map and topography. *Lond. Nat.*, 24, 34.
 JONES, A. W., 1954, The Flora of Bookham Common. *Lond. Nat.*, 33, 25-47.

The Stag Beetle Survey—First Report

By D. G. HALL

H. LANGFORD LEWIS wrote a short note in the *Entomologist's Monthly Magazine* in 1941 (Vol. 77, p. 180) in which he posed some pertinent questions regarding the stag beetle *Lucanus cervus* (L.). He asked if any readers could give an explanation for its curiously restricted range and concluded by stating that he would like to see a careful note as to its true distribution. The following month in the same journal H. St. J. K. Donisthorpe (p. 198) discussed the range of the beetle and listed the vice-counties in which it was known to occur. The present survey has been designed to give a more accurate picture of the beetle's distribution as far as the London area is concerned. The stag beetle does not lend itself to the more usual treatment of vice-county distribution as it is very localized in its distribution. Its main centre in Britain is without doubt the southern fringe of the London area with small pockets along the Thames valley, in North London, Kent, Sussex and Hampshire: it also occurs in a few more isolated areas elsewhere.

It is usual for insect distribution surveys to be carried out by scientific workers and often the findings are restricted to published data only. The need for this care is obvious when one realizes the difficulty that even experts find in identifying their specimens. The stag beetle is, however, one of the few British insects that is widely known by the general public and it is not easily mistaken for anything else. Although the female of the species is similar in appearance to the female *Dorcus parallelipedus* (L.) it is considered that sufficient records have been received to make any errors relatively unimportant.

The chief difficulty was to make the survey known to as wide a field of naturalists as possible. The survey was publicised at every indoor meeting for a period. Articles appeared in the press and in 1960 an appeal was made through the B.B.C. in its programme "Nature News" and a note appeared in the editorial of the *New Scientist*. Letters were also sent to local museums. I am grateful to the following who have sent in records:—

A. A. Allen, E. Babbs, F. Bancroft, E. B. Bangerter, D. Barnard, G. W. R. Bartindale, H. J. Belsky, L. S. Beaufoy, G. Beven, F. G. Berry, M. C. Birch, R. Bland, K. H. Bobe, M. Bournat, W. H. Brends, M. Bridges, C. Bruce, J. F. Burton, B. L. J. Byerley, J. Collins, L. Christie, Dr. J. L. Cloudsley Thompson, M. Crussell, Miss M. Callcott, B. N. Dosetiel, W. J. Durrant, Eltham Green School Natural History Club, W. J. Eeles, H. Davoll, A. W. Evans, R. W. Elsey, Mrs. E. S. Everard, Dr. A. M. Easton, G. Egerton, E. J. D. Field, Mrs. A. Fraser, G. B. Edwards, R. J. Gent, M. J. Foreman, D. Goff, P. R. S. Gibson, J. Griffiths, L. R. A. Grove, R. J. Coater, V. Green, A. Hutson, N. Hopkins, K. H. Hyatt, Miss E. C. Isherwood, H. Jones, A. W. Jones, Miss L. J. Johns, R. C. Kenedy, A. J. Legge, A. E. LeGros, E. Lewis, Lewisham Natural History

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During the survey a large number of pre- 1959 records were sent in and these have been included. They are particularly interesting in that they show where the beetle has occurred in former years and it would be interesting if members could look in these localities to see if it still occurs there.

Members were asked to send in details of sex, number of specimens and date seen and any other useful information.

The records received have been summarized in Table A. The date last recorded is given.

TABLE A.—LOCALITIES IN WHICH STAG BEETLE REPORTED.

Vice-county 16—West Kent					
	1959	1960		1959	1960
Abbey Wood		x	Eltham		x
Beckenham		x	Lee	x	x
Blackheath	x	x	Lewisham	x	x
Bostall Heath		x	Lullingstone	x	
Brockley		x	Orpington		x
Bromley	x	x	Plumstead Common		x
Catford		x	Sidcup		x
Charlton	x		Upper Belvedere		x
Danson Park		x	Woolwich		x
Chislehurst		x			
Dartford (57), Dartford (53), Greenwich (47), Mottingham (36) and Darenth Park (05).					
Vice-county 17—Surrey					
	1959	1960		1959	1960
Barn Elms	x		Norbury		x
Bookham		x	Petersham	x	x
Carshalton	x	x	Putney	x	
Croydon	x		Richmond Park	x	x
Esher	x		Streatham	x	x
Kew Gardens		x	Surbiton	x	
Leatherhead		x	Walton-on-Thames		x
Mitcham	x		Wimbledon	x	x
Camberwell and Sydenham (58), Wimbledon Common (53), Barnes and Box Hill (52), Sutton (51), Addiscombe (50), Purley (44), Southwark (26), Ashted (02), Chertsey (1899), Beddington (1889), Chalford (1886), Undated records from Epsom, South Norwood, Sheen and Stoneleigh.					
Vice-county 18—South Essex					
	1959	1960		1959	1960
Loughton		x	Upminster		x
Tilbury	x		West Thurrock	x	
Theydon Bois (55), Chingford, Grays and Stifford (48), Dagenham (41), Romford (35) and Brentwood (17).					

Vice-county 20—Hertfordshire
Waltham Cross (59) and Cheshunt (47).

Vice-county 21—Middlesex			
	1959	1960	
Enfield		x	Shepperton
Fulham		x	Staines
Hanworth	x	x	Southall
Mill Hill		x	
Hounslow (58), Northwood (54), Chiswick (46), Lampton and Teddington (41), Fulwell (39), Harrow North (37), Hampton Court (24), Chelsea (10) and Holborn (1898).			

These tables suggest that either the beetle was more common in 1960 than in 1959 or the observers were more observant. Dr. J. L. Cloudsley Thompson has stated that in some years the males seem to be more common than in other years. In 1959, 38 records were received in which all the data requested was included, compared with 87 in 1960. The following table suggests that the females outnumbered the males by two to one in 1959 but that the proportions were equal in 1960. The months have been divided into three periods of approximately ten days each.

TABLE B.—DISTRIBUTION OF OBSERVATIONS OF STAG BEETLE

		1959		1960	
		Males	Females	Males	Females
May	1-10	—	—	1	—
May	11-20	—	—	—	—
May	21-31	—	—	2	1
June	1-10	2	1	12	7
June	11-20	6	6	12	13
June	21-30	2	9	11	14
July	1-10	2	4	3	3
July	11-20	1	4	1	4
July	21-31	—	—	—	2
August	1-10	—	1	—	—
August	11-20	—	—	1	—
		13	25	43	44

From this table it can be shown that the peak dates for recording are as follows:

	Males	Females
1959	June 19	June 28
1960	June 16	June 23

In both years therefore the males appeared about one week before the females.

It is proposed to continue the survey for at least another year. It may then be possible to see if there is any cycle in the ratio of males to females and whether the numbers seen each year vary. It would be appreciated therefore if members would keep a look-out for stag beetles especially during the month of June and send records to the Society's Recorder of Coleoptera.

During the survey many records were received from outside the London area and together with additional information from future records it is hoped to produce a further report in a year or two's time.

A Preliminary List of the Coleoptera of Farningham Wood, Kent

By K. C. SIDE

SEVERAL field meetings have been held by both the Botany and Entomology Sections of the London Natural History Society at Farningham Wood, Kent, but no detailed reports of the insects have hitherto been published.

The wood lies a few hundred yards north of the A.20 road, well within the Society's area. It consists of about half a square mile of mixed woodland, most of which is above the 300 foot contour and at one point just exceeds 400 feet in height. The flora is varied and contains a number of very local vascular plants and bryophytes. The variety of the flora is largely due to the fact that in this small area no less than three different geological strata come to the surface. These are the Chalk, the Thanet Sands and the Woolwich and Reading Beds.

On the western edge of the wood, and at a slightly lower elevation, is a sandy slope with scattered birches, young oaks, broom and heather. This more open habitat is included in the survey and in fact it forms one of the most interesting collecting grounds in the area. At this edge of the wood, also, heaps of vegetable refuse from a local farm are often deposited, and these usually support a rich and varied beetle population.

The list of Coleoptera given below is the result of some two or three visits each year since 1954. It probably represents only a small proportion of the beetles present and in a later paper it is hoped to make the list more complete. For this purpose any observations made by other Coleopterists will be gratefully received. A few of the species listed here were recorded by D. G. Hall and these are indicated by his initials in brackets. The Roman figures refer to the months when the species were seen.

Nomenclature is according to the *Check-List of British Insects* compiled by G. S. Kloet and W. D. Hincks, 1945, except in a few families where more recent work has shown the Check-List names to be not valid. The names used in Dr. Norman Joy's *Handbook of British Beetles*, 1934, are added in square brackets where it is thought that these may be more familiar to Coleopterists who make use of that work.

CARABIDAE

Cicindela campestris L. Flying in warm sunshine. Sandy bank at western edge of wood. iv.

Carabus problematicus Herbst ssp. *gallicus* Géhin. [*C. catenulatus* Scop.]

Under loose bark of pine stump. iii.

Leistus ferrugineus (L.) Heap of dead potato haulms. xi.

Notiophilus aquaticus (L.) Running on ground. ix.

N. rufipes Curtis. On ground. (D.G.H.)

N. biguttatus (Fab.) Common in grass tufts, under stones and running on the ground. iv, v.

Asaphidion flavipes (L.) Sandy bank at western edge of wood. vi.

Bembidion lampros (Herbst) On the ground and under stones. iv, vi.

B. nitidulum (Marsh.) Under stone. v.

Badister bipustulatus (Fab.) In heap of vegetable refuse. iv.

Harpalus affinis (Schränk) [*H. aeneus* (Fab.)] Under stones. vi.

H. attenuatus Steph. On ground and under stones. iv. ix.

- H. rubripes* (Duft.) Sandy bank at western edge of wood. iv.
H. rufipes (Deg.) [*Pseudophonus pubescens* (Müll.)] Under stone. v.
Bradycellus ruficollis (Steph.) [*B. similis* (Dej.)] At roots of heather on the sandy bank at western edge of wood. ii.
B. sharpi Joy. Heap of litter in the wood. i.
B. verbasci (Duft.) Grass roots. iii.
Amara aenea (Deg.) Sandy bank at western edge of wood. iv.
A. familiaris (Duft.) Under stones. iv.
A. tibialis (Payk.) Very abundant in the open area west of the wood. iv, vi, ix.
Abax parallelipedus (Pill. & Mitt.) [*A. ater* (Vill.)] On ground. v.
Synuchus nivalis (Panz.) On ground. vii.
Agonum dorsale (Pont.) [*Anchomenus dorsalis* Pont.] Frequent under stones. iv.
Demetrias atricapillus (L.) Grass roots. ii.
Dromius linearis (Ol.) Very common at grass roots and in vegetable refuse. Once under bark of dead branches on the ground. ii, iv, v, vi, xi.
D. melanocephalus Dej. Very common at grass roots and in vegetable refuse. ii, iv.
Metabletus foveatus (Geoff.) Very common at roots of grass, under stones and running on the ground. Also amongst dead leaves ii, iii, iv, vi, ix.

HYDROPHILIDAE

- Cercyon analis* (Payk.) Very common in vegetable refuse. iii, iv, v.
Megasternum obscurum (Marsh.) Heap of straw. v.

SILPHIDAE

- Nargus velox* (Spence) Vegetable refuse. i.

SCYDMAENIDAE

- Scydmaenus tarsatus* Müll. Vegetable refuse. iv.

PTILIIDAE

- Ptenidium pusillum* (Gyll.) In vegetable refuse in countless numbers. ii, iii.
Acrotrichis intermedia (Gillm.) Heap of chaff and straw. iv.

STAPHYLINIDAE

- Pseudopsis sulcata* Newman. Heap of straw. v.
Megarthus affinis Miller. Heap of vegetable refuse. xii.
Proteinus brachypterus (Fab.) Vegetable refuse. xii.
P. ovalis Steph. At grass roots and in vegetable refuse. ii, x, xii.
Eusphalerum luteum (Marsh.) [*Anthobium ophthalmicum* Pk.] On flowers of Umbelliferae, especially Hogweed. Common. vii.
Anthobium unicolor (Marsh.) [*Lathrimaeum unicolor* Marsh.] Grass roots. ii.
Omalium caesum Grav. Vegetable refuse. xii.
O. italicum Bern. Heap of straw. iii.
O. rivulare (Payk.) Very common in heaps of vegetable refuse. iv, x, xi.
Phloeonomus punctipennis Thoms. Under bark of beech. i.
Xylodromus concinnus (Marsh.) Grass roots and vegetable refuse. iv, x.

- Coryphium angusticolle* Steph. Under bark of dead branches. iv.
Oxytelus rugosus (Fab.) var. *pulcher* Grav. By sweeping the vegetation at the edge of one of the rides. vi.
O. sculpturatus Grav. On the ground. vi.
Stenus clavicornis (Scop.) Grass roots and vegetable refuse. i, ii.
S. formicetorum Mann. Vegetable refuse. iv.
S. impressus Germar. At grass roots and amongst dead leaves. i, iv.
S. ossium Steph. By sweeping in the evening. v.
S. fulvicornis Steph. Heap of straw. ii.
Astenus pulchellus (Heer.) Heap of straw. i.
Rugilus orbiculatus (Payk.) [*Stilicus orbiculatus* Pk.] Heap of straw. ii, v.
Leptacinus bathychrus (Gyll.) Heap of straw. v.
L. parumpunctatus (Gyll.) Heap of straw. v.
L. sulcifrons (Steph.) [*L. linearis* (Grav.)] Straw and other vegetable refuse. iv, v.
Xantholinus linearis (Ol.) On the ground and in vegetable refuse. iv, vi.
Philonthus concinnus (Grav.) On the ground. iii.
P. fimetarius (Grav.) Common in vegetable refuse. iii, iv, v, xii.
P. fuscipennis (Mann.) At grass roots and in vegetable refuse. ii, iv, ix.
P. sordidus (Grav.) Straw and other vegetable refuse. iii, iv.
P. succicola Thoms. In fungus. ix.
P. varius (Gyll.) Grass roots. iv.
Gabrius nigritulus (Grav.) Heap of cut grass and weeds. iv.
Staphylinus globulifer Geoff. Under stones. iv.
Heterothops dissimilis (Grav.) Vegetable refuse. iv, v.
Quedius assimilis (von Nord) Vegetable refuse. iv.
Q. boops (Grav.) Heap of straw. v.
Q. cinctus (Payk.) Heap of straw. v.
Q. cruentus (Ol.) Heap of straw. v.
Q. nemoralis Baudi. Heap of straw. v.
Q. rufipes (Grav.) Heap of straw. iii.
Q. scintillans (Grav.) Vegetable refuse. iv.
Q. semiaeneus Steph. Heap of straw. v.
Habrocerus capillaricornis (Grav.) Straw and other vegetable refuse. iii, iv, v.
Lordithon exoletus (Er.) [*Bolitobius exoletus* Er.] In toadstools. ix.
L. thoracicus (Fab.) [*B. thoracicus* F.] In toadstools. ix.
L. trinotatus (Er.) [*B. trinotatus* Er.] Common in toadstools. ix, x.
Conosumus littoreus (L.) Vegetable refuse. i.
Tachyporus chrysomelinus (L.) Common amongst grass roots and dead leaves. i, ii, iv.
T. hypnorum (Fab.) Very abundant at grass roots, in vegetable refuse and occasionally by sweeping. i, ii, iii, v, ix, xii.
T. nitidulus (Fab.) Grass roots and in vegetable refuse. iii, iv.
T. solutus Er. On the ground. vi.
Tachinus rufipes (Deg.) Vegetable refuse. iv.
T. subterraneus (L.) Vegetable refuse. iv, xii.
Hypocyptus longicornis (Payk.) Grass roots and dead leaves. iv.
Oligota inflata Mann. Vegetable refuse. xii.
Placusa pumilio (Grav.) Under bark of oak branches lying on the ground. i.
Thectura cuspidata (Er.) Under beech bark. i.
Atheta (*Glossola*) *gregaria* (Er.) [*Aloconata gregaria* Er.] At grass roots and once under loose bark of dead branch. ii, iv.

- A. (Microdota) amicula* (Steph.) Vegetable refuse. xii.
A. trinotata (Kr.) Vegetable refuse. x.
A. triangulum (Kr.) Grass roots and vegetable refuse. i, ii, iii, iv, xii.
A. euryptera (Steph.) Vegetable refuse. iii.
A. (Acrotona) aterrima (Grav.) [*Dimetrota aterrima* Gr.] Vegetable refuse. iv.
A. (Acrotona) fungi (Grav.) Very abundant at grass roots. ii, iv.
Amischa analis (Grav.) At grass roots. ii.
Drusilla canaliculatus (Fab.) [*Astilbus canaliculatus* F.] Common at grass roots. ii, v.
Phloeopora testacea (Mann.) Under beech bark. i.
Oxypoda alternans (Grav.) In toadstools. ix.
Ischnoglossa prolixa (Grav.) Under oak bark. vii, ix.
Cratarea suturalis (Mann.) Vegetable refuse. x.
Aleochara bipustulata (L.) Amongst dead leaves. iv.

PSELAPHIDAE

- Euplectus piceus* Mots. Under bark of dead branches. iv.

CANTHARIDAE

- Cantharis rustica* Fall. On flowers. vi.
C. cryptica Ashe On flowers. vi. This species was formerly included with *C. pallida* Goeze. The true *pallida* is associated with aquatic vegetation and occurs beside the River Darent a mile away.
Rhagonycha lignosa (Müll.) On flowers. vi, vii.
R. lutea (Müll.) On flowers. vi.
R. fulva (Scop.) On flowers, especially Hogweed. Very common. vii.
Malthinus flaveolus (Payk.) By sweeping. vi.
Malthodes minimus (L.) By sweeping. vi, vii.

MALACHIIDAE

- Malachius bipustulatus* (L.) On flowers. vi.
Anthocomus fasciatus (L.) By sweeping. v.

ELATERIDAE

- Limonium aeruginosus* (Ol.) By sweeping. vi.
Athous haemorrhoidalis (Fab.) Common. By sweeping. vi.
A. hirtus (Herbst) By sweeping. vi.
Agriotes acuminatus (Steph.) Common. By sweeping. v, vi, vii.
A. pallidulus (Ill.) By sweeping. v, vi.
A. sputator (L.) On the ground. v.
Dalopius marginatus (L.) By sweeping. v.
Denticollis linearis (L.) By sweeping. vi.

DERMESTIDAE

- Anthrenus verbasci* (L.) On various flowers. vii.

BYTURIDAE

- Byturus ochraceus* (Scriba) [*B. fumatus* F.] Common on various flowers. v, vi, vii.
B. tomentosus (Deg.) On flowers. vi.

NITIDULIDAE

- Brachypterus glaber* (Steph.) On Hogweed blossoms. vii.
B. urticae (Fab.) By sweeping. vi.
Meligethes aeneus (Fab.) On various flowers. v.

- M. erythropus* (Gyll.) On flowers. vi.
Epuraea aestiva (L.) On flowers. v.
Librodor quadriguttatus (Fab.) Under bark. v.

RHIZOPHAGIDAE

- Rhizophagus bipustulatus* (Fab.) Under beech bark. i.

CUCUJIDAE

- Monotoma bicolor* Villa. Vegetable refuse. x.
M. picipes Herbst. Heap of straw. v.

CRYPTOPHAGIDAE

- Cryptophagus dentatus* group. Specimens referable to this complex group of species were taken in straw and vegetable refuse. iii, v.
C. pilosus Gyll. Straw and vegetable refuse. x, xii.
C. saginatus Sturm. Vegetable refuse. x.
C. scutellatus Newman. Vegetable refuse. iv, x.
Atomaria analis Er. Vegetable refuse. iii.
A. atricapillus Steph. Vegetable refuse. iii.
A. fuscata (Schön.) By sweeping. v, vi.
A. munda Er. Vegetable refuse. x.

PHALACRIDAE

- Stilbus testaceus* (Panz.) Amongst grass roots. iv.
Olibrus aeneus (Fab.) Amongst grass roots. ii.

LATHRIDIIDAE

- Lathridius bifasciatus* Reitter. By sweeping. ix. This is an Australian species which was first recorded in Britain by A. A. Allen who took some specimens in Surrey in 1950. Since then it has spread in south-east England and, in my experience, it is now the commonest species of the genus in West Kent.
L. lardarius (Deg.) By sweeping. v.
L. nodifer Westwood. In fungus. ix.
Enicmus transversus (Ol.) Vegetable refuse. iv, v.
Cartodere ruficollis (Marsh.) Vegetable refuse, x.
Corticarina fuscata (Gyll.) [*Melanophthalma fuscata* Gyll.] Grass roots. iv.
C. gibbosa (Herbst) [*M. gibbosa* Hbst.] Grass roots. iv.

MYCETOPHAGIDAE

- Typhaea stercorea* (L.) Heap of straw and other vegetable refuse. v, x.

ENDOMYCHIDAE

- Mycetaea hirta* (Marsh.) Vegetable refuse. iv, xii.

COCCINELLIDAE

- Rhyzobius litura* (Fab.) Grass tuft. iv,
Adalia bipunctata (L.) By sweeping. vi.
A. decempunctata (L.) At grass roots and by sweeping. iv, vi.
Coccinella undecimpunctata L. At grass roots. iv.
C. septempunctata L. At grass roots. ii.
Myrrha octodecimpunctata (L.) Resting on beech trunk. iv.
Thea 22-punctata (L.) By sweeping. v, vi.
Propylia 14-punctata (L.) Amongst dead leaves and by sweeping. iv, v.

Chilocorus renipustulatus (Scriba). By sweeping. v.

Exochomus quadripustulatus (L.) By sweeping. vi.

CISIDAE

Octotemnus glabriculus (Gyll.) In fungus on dead birch branches. iv.

OEDEMERIDAE

Oedemera lurida (Marsh.) On flowers, especially *Leontodon*. vi.

MORDELLIDAE

Mordella aculeata L. By sweeping. vii.

Anaspis costai Emery. By sweeping. vi.

A. humeralis (Fab.) By sweeping. vi.

A. lurida Steph. vi. (D.G.H.)

A. maculata Geoff. On various flowers. v.

A. pulicaria Costa. On various flowers. vi.

A. regimbarti Schil. On various flowers. vi, vii.

A. rufilabris Gyll. On various flowers. vi.

A. garneysi Fowler. On flowers. vi.

ANTHICIDAE

Anthicus quisquilius Thoms. Heap of straw. v.

ALLECULIDAE

Isomira murina (L.) By sweeping. vi.

SCARABAEIDAE

Aphodius prodromus (Brahm) By sweeping. v. An unusual way of obtaining this quite common dung beetle.

CERAMBYCIDAE

Grammoptera ruficornis (Fab.) By sweeping. vi.

Strangalia maculata (Poda) On Hogweed blossom. vi.

S. melanura (L.) By sweeping. vii.

Clytus arietis (L.) By sweeping. vi.

CHRYSOMELIDAE

Lema melanopa (L.) Grass roots. ii, iii.

Cryptocephalus fulvus Goeze. By sweeping. ix.

C. aureolus Suff. On yellow flowers. vi. (D.G.H.)

Gastrophysa polygoni (L.) [*Gastroidea polygoni* L.] In flight. iv.

Phyllodecta vitellinae (L.) Hibernating under bark of dead pine. i.

This species is normally associated with willows.

Phyllotreta atra (Fab.) By sweeping. v.

P. exclamationis (Thun.) By sweeping *Alliaria petiolata* just outside the wood. v.

P. ochripes (Curtis). By sweeping. v.

P. undulata Kutsch. On *Alliaria petiolata* just outside the wood. v.

Aphthona venustula Kutsch. By sweeping. v. vi.

Longitarsus gracilis Kutsch. Sweeping Ragwort. ix.

L. jacobaeae (Waterhouse). Sweeping Ragwort and grass. vii, ix.

Chaetocnema concinna (Marsh.) Amongst dead leaves. iv.

Apteropeda orbiculata (Marsh.) By sweeping. v.

Cassida flaveola Thunb. By sweeping. v.

C. rubiginosa Müll. By sweeping. vi.

Bruchus loti Payk. Sweeping the open area at western edge of wood. vi.

Bruchidius fasciatus (Ol.) [*Laria cisti* Pk.] On Rock-rose in the same area as the preceding. vi.

CURCULIONIDAE

Lasiorrhynchites ophthalmicus (Steph.) [*Rhynchites sericeus* Fow.] vi. (D.G.H.)

Caenorhinus germanicus (Herbst) [*Rhynchites germanicus* Hbst.] By beating young trees. vi.

C. aequatus (L.) [*R. aequatus* L.] On hawthorn. vi. (D.G.H.)

Deporaus betulae (L.) [*R. betulae* L.] By beating young birches. vi.

Apion apricans Herbst. By sweeping. v.

A. carduorum Kirby. By sweeping thistles. vi.

A. cracca (L.) In grass-tuft and amongst dead leaves. i.

A. cruentatum Walton. On dock. vi. (D.G.H.)

A. dichroum Bedel [*A. flavipes* Pk.] By sweeping. v.

A. dissimile Germar. At grass roots. ii.

A. loti Kirby. By sweeping the open area at western edge of wood. vi.

A. miniatum Germar. On dock. vi. (D.G.H.)

A. nigrirtarse Kirby. By sweeping. vi.

A. pisi Fab. By sweeping. ix.

A. pomonae (Fab.) In grass tuft and amongst dead leaves. i.

Phyllobius argentatus (L.) By beating young trees, especially birch. vi.

P. pomaceus Gyll. [*P. urticae* Deg.] On nettles. v.

P. pyri (L.) By beating various trees. v.

Polydrusus cervinus (L.) By beating various trees. vi.

P. mollis (Stroem.) By beating young trees. vi.

P. pterygomalis Boh. On young trees. vi.

P. tereticollis (Deg.) On young trees. v, vi.

Sciaphilus asperatus (Bons.) By sweeping. v, vi.

Strophosomus melanogrammus (Forster). Amongst dead leaves and by beating hazels. iv, v.

S. nebulosus Steph. [*S. retusus* Marsh.] Sweeping at western edge of wood. v.

S. subrotundus (Marsh.) [*S. rufipes* Steph.] In dead leaves and by sweeping and beating birch. iv, v, vi, vii, ix.

Cneorrhinus plumbeus (Marsh.) [*Atactogenus exaratus* Marsh.] By sweeping. vi.

Sitona hispidulus (Fab.) Sweeping open area at western edge of wood. v.

S. humeralis Steph. Sweeping open area at western edge of wood. vi.

S. lepidus Gyll. [*S. flavescens* Marsh.] At grass roots. ii.

S. regensteiniensis (Herbst). Very common on broom. iii, iv, v, vi.

S. lineatus (L.) At grass roots. ii.

Miccotrogus picirostris (Fab.) By sweeping. v, vi.

Curculio glandium Marsh. [*Balaninus glandium* Marsh.] vi. (D.G.H.)

C. (Balanobius) pyrrhoceras Marsh. By beating oak. vi.

C. (Balanobius) salicivorus Payk. On willows. vi.

Magdalis cerasi (L.) By sweeping. vi.

Epipolaeus caliginosus (Fab.) Under bark of dead branches lying on the ground. iv.

Acalles roboris Curtis. By evening sweeping. v.

A. ptinoides (Marsh.) vi. (D.G.H.)

Micrelus ericae (Gyll.) On heather at western edge of wood. vi.

Cidnorhinus quadrimaculatus (L.) [*Ceuthorrhynchus quadrimaculatus* L.]

On nettles in spring and in vegetable refuse in winter. iii, v, vi.

Ceuthorrhynchus assimilis (Payk.) By sweeping various Cruciferae. v, vi.

C. floralis (Payk.) With the preceding species. v, vi.

C. pleurostigma (Marsh.) With the preceding species. vi.

Cionus hortulanus (Geoff.) Sweeping Figwort. vi. (D.G.H.)

Cleopus pulchellus (Herbst.) [*Cionus pulchellus* Hbst.] Sweeping Figwort. vi. (D.G.H.)

Anoplus plantaris Naesz. By sweeping. v, vi.

Rhynchaenus stigma Germar. [*Orchestes stigma* Germar.] Beating willows. v, vi, vii.

Further Records of Conopidae (Diptera)

By B. L. J. BYERLEY

JUST after the publication of "Flies of the London Area 1. Conopidae" (Parmenter, 1952) a key to this interesting family was published (Smith, 1952). These two publications stimulated my interest in this group and I thought it might be worth placing on record two additions to the original list.

The first, *Leopoldius signatus* (Wied.), was found at Whippendell Wood, Herts on 13 and 14 October, 1952, a total of 26 specimens being captured on the two days, 16 males and 10 females, including three pairs in cop. All were on Ivy blossom which covered a dead tree stump up to approximately 12 feet from the ground. Unfortunately, the only Ivy that blooms in the area now is at least 20 feet from the ground, so that further study is difficult particularly as I think the flight period of the species is very short.

British material of *Thecophora pusilla*, a species recorded by Parmenter (1952) from Bookham Common and Mickleham, is now regarded as a small form of *T. atra* (Smith, 1959). I took two specimens on *Hypericum perforatum* on 15 August, 1954, at Harefield Grove, Herts. This site was visited on 18, 28 and 29 August and 3 October, each visit producing one or two specimens. Three specimens were also taken at Whippendell Wood, Herts on 2 October, 1954.

Any further records for this family would be greatly appreciated.

REFERENCES

- PARMENTER L., 1952, Flies of the London Area 1. Conopidae. *Lond. Nat.* 31, 25-29.
 SMITH K. G. V., 1952, The Irish Conopidae. *Proc. R. Irish. Acad. (B)*, 54, 203-8.
 ———, 1959, The Distribution and Habits of the British Conopidae. *Trans. Soc. Brit. Ent.*, 13, 113-136.

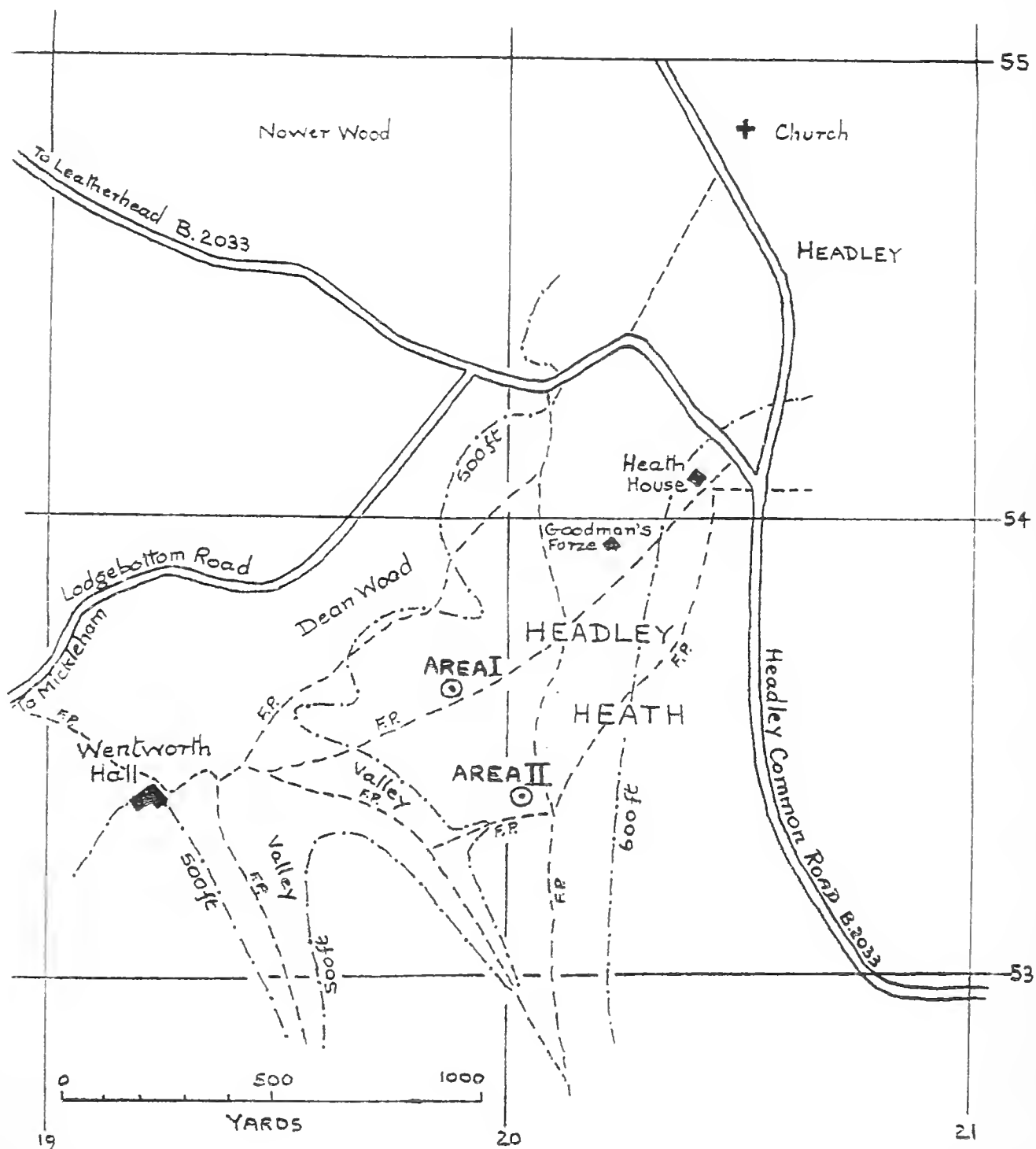
Headley Heath Survey

A ten-year study of the re-colonization by plants of denuded heathland.

By E. M. HILLMAN and C. P. CASTELL

DURING the Second World War many areas of heathland in Britain were denuded of top soil as a result of army manoeuvres. It was noticed that some of these areas on Headley Heath, Surrey were still conspicuously devoid of vegetation in 1951 and it was decided to study the rate at which the regeneration of heathland took place on two of them.

The survey is of necessity limited in scope. Only one annual visit could be paid to the areas, and in order to complete the work in one day only one transect could be made in each area. The figures obtained, although they are subject to sampling and other errors which cannot be



precisely stated, do, we believe, give a fair picture of the changes which have taken place in the ten years, since it can easily be verified by even casual observation on the spot that the main trends which they indicate apply to the area as a whole.

This is a modest experiment with a team of amateur workers, but it possesses the merit of extending in time, and whereas certain natural successions are known to take place, there is little information as to the rate at which they do so. In fact, "In a random selection of over 30 papers on succession written between 1930 and 1940 none refers to the rate at which the process was taking place" (Burges, 1960).

It is necessary to bear in mind that forty years ago Headley Heath was described as "Heather Moor", but by 1937, heather had been replaced over most of the area by bracken, the rapid spread of which has been attributed to frequent heath fires.

POSITION AND DESCRIPTION OF THE AREAS CHOSEN FOR STUDY

Both survey areas lie on the western slopes of the 600 ft. plateau of Headley Heath, at a height of about 350 ft. and on what is described by the Geological Survey as "red loam with flints" and mapped under the general term "Clay with Flints". "Coarse sand with few stones" was noted by the Survey in two areas a few hundred yards to the west, one at about the same height (500-550 ft.) and the other on lower ground (c. 450 ft.). It will be seen below that neither of these descriptions can be applied to the surface material of either of the survey areas.

Chalk underlies the plateau deposits and is exposed at the surface in valleys 200 yds. to the west and consequently the soil is usually well drained and, especially in the survey areas, becomes very dry in the summer.

Exposure to the sun in a good summer, combined with the frequent strong winds during most of the year, produces conditions inimical to the establishment of vegetation, especially when aggravated by rabbit grazing.

AREA I (Map Reference: TQ(51)198536)

An area some 150 ft. square of small flint pebbles from one to two inches in diameter with many flint cobbles from four to seven inches in length and a little sand.

There were many rabbit droppings and much evidence of grazing in 1954. In 1956 there was no sign of rabbits, but in 1960 there were numerous droppings in several places, although no evidence of grazing could be seen.

In 1960 Gorse, *Ulex europaeus* and Wavy Hair Grass, *Deschampsia flexuosa* were frequent to locally dominant. The moss *Polytrichum piliferum* was abundant and locally dominant between stones and covered areas of thin soil. Fine-leaved Heath, *Erica cinerea*, was frequent and Wood Sage, *Teucrium scorodonia*, locally abundant. Birch, *Betula pendula*, was represented by a few young plants and the two isolated trees marking the line of transect and now producing catkins. The following occurred under the birches:

Deschampsia flexuosa (dominant), *Holcus lanatus*, *Rumex acetosella* and the fungi *Amanita muscaria* and *Lactarius turpis*.

Occasional species were:—*Agrostis tenuis*, *A. canina* subsp. *montana*, *Hypochoeris radicata*, young plants of *Rubus fruticosus*, *Rumex acetosella* and *Ulex nanus*. Heather, *Calluna vulgaris*, was not observed in 1954,

was recorded in 1956, but was still rare in 1960. Other species recorded as present in the area are *Cerastium holosteoides*, the mosses *Ceratodon purpureus* and *Pohlia nutans* and the lichen *Cladonia* sp.

The following occurred in 1954 but were not observed in 1960:—*Moehringia trinervia*, *Carex* sp., *Chamaenerion angustifolium*, *Hieracium pilosella*, *Galium saxatile*, *Luzula campestris*, young *Sambucus nigra*, *Senecio jacobaea*, *Taraxacum* sp., *Veronica chamaedrys*, and the moss *Dicranella heteromalla*.

VEGETATION IN THE VICINITY OF AREA I.

Dense Gorse occurs immediately to the west and extends, accompanied by Bracken, Bramble, Birch and Oak for about 100 yards. Near the transect, the gorse is three to four feet high and much higher elsewhere. Bare patches of pebbly ground can still be seen over much of this gorse area, suggesting that it is part of the cleared area, but in a more advance state of colonization.

To the north is a shallow valley covered with bracken and birch and much gorse and occasional Dwarf Gorse, Bramble, Elder and Wood Sage.

A steep valley lies to the south, the slopes covered with gorse and bracken, much bramble and Rosebay, *Chamaenerion angustifolium*, frequent birch and occasional elder.

To the east, an area of bracken extends for some 150 yds., with much gorse and birch (*Betula pendula* and occasional *B. pubescens*). Heather (*Calluna*) and Heath (*Erica cinerea*) are restricted to the edges of paths. Between this and another extensive cleared area is *Calluna-Erica* grassland, with much bracken. The centre of the cleared area is still mainly bare ground with scattered clumps of *Deschampsia flexuosa*, local dominance of *Polytrichum* and occasional clumps of *Cladonia*. Further from the centre, *Erica*, *Calluna*, *Ulex europaeus* and *U. minor* become locally abundant.

AREA II (Map Reference: TQ(51)200534)

An area of sand and pebbles, about 200 ft. square traversed by wide shallow parallel furrows about eight feet wide in which sand has accumulated and pebbly ridges about six inches high. The sand is blown about by the wind and tends to collect around *Erica cinerea* and *Deschampsia flexuosa* to form little hillocks. A path has been trodden by the public in the last few years across the area parallel to, and about ten yards to the west of, the transect and this appears to prevent colonization in that part. A much-used path runs at right angles to the transect about 30 yards to the north.

There were numerous rabbit droppings and very heavy grazing by rabbits in 1954. *Calluna vulgaris* suffered severely; one clump was grazed to the ground, while a contiguous *Erica cinerea* plant was untouched. *Deschampsia flexuosa* was also grazed. There was no sign of rabbits in 1956 and droppings were seen only in one place in 1960.

In 1960 *Erica cinerea* was abundant and locally dominant, while the moss *Polytrichum piliferum*, as in Area I, was abundant and locally dominant in the hollows; both male and female plants were observed. Young plants of *Betula pendula* from six inches to two feet high were occasional; the much older tree marking the zero point of the transect and a smaller one at 40 ft. were producing catkins.

Occasional species were: *Deschampsia flexuosa*, *Calluna vulgaris*, *Ulex nanus* and *Agrostis* sp. Others recorded were: *Galium saxatile*, *Hypochoeris radicata*, *Pteridium aquilinum*, *Sarothamnus scoparius*, *Senecio jacobaea*, the mosses *Ceratodon purpureus*, *Dicranella heteromalla* and *Pohlia nutans*, the fungus *Laccaria laccata* and the lichen *Cladonia* sp.

Campanula rotundifolia, *Rumex acetosa*, *Teucrium scorodonia* and the fungus *Clavaria argillacea* were not seen in 1960, although recorded in previous years.

VEGETATION IN THE VICINITY OF AREA II

To the south, there is a continuation of the steep valley, dominated by gorse, of Area I. To the north is *Calluna-Erica* grassland with birch and bracken, gorse and dwarf gorse. A similar type of vegetation occurs to the west, but with local dominance of bracken and local patches of grass and some bramble, rose-bay (*Chamaenerion angustifolium*) and sheep's sorrel (*Rumex acetosella*).

LOCATION OF TRANSECTS

The positions of the transects were not chosen at random, but so as to give, as far as one could foresee, results representative of the areas as a whole.

In Area I the transect is a *belt* six inches wide and 66 feet long, about halfway between the centre and the edge of the denuded area.

In Area II the transect is a *line* 66 feet long which was chosen to run transversely to the ridges and hollows, since a line running along a hollow or ridge would give a biased result for the vegetation.

In order to make it possible to find the transects again after a lapse of time the two ends were placed at or near birch trees, and from these, bearings were taken of a number of landmarks, some of which soon became obscured by tree growth. The subsequent finding of "Zero Birch" was usually quickly done, but in the earlier years some difficulty was experienced in finding the line of the tape. Metal skewers sunk into the ground at measured intervals proved useful, although one of these is now in the centre of the gorse bush and another swallowed by a growing tree trunk. The best guide now to the annual laying of the tape is the recorded positions of some of the well-established plants of the transect.

METHOD

The work of recording was divided up among the workers available. The length of the transect occupied by the various species was noted. Lichens were excluded, except in 1955. It was found expedient to record the dominant moss, *Polytrichum piliferum*, separately.

More than one species may be recorded for the same stretch of transect, particularly in Area I, where the species can exist side by side in the six-inch belt, but overlapping can occur also in Area II, where one plant is vertically above another or where two are closely intermingled. There was not time to measure the transverse extent of each plant across the 6-inch belt. The meaning of the measurements is discussed later.

We now define the following terms:

COVERAGE for a species is the length of transect occupied by it. If small plants were too numerous to record separately, the species would be entered as "scattered" and the distance for which this extended is

halved in estimating its coverage. This is an arbitrary decision, but the best that can be devised.

TOTAL COVERAGE is the sum of the coverage of all species, except mosses and lichens, in a given year.

PERCENTAGE COVERAGE of a species is its coverage as a percentage of this Total Coverage.

DOMINANT PLANT is the species with the greatest coverage in a particular year.

In the case of the dominant moss, *Polytrichum piliferum*, it has become clear in the light of experience that accurate figures for coverage can only be obtained in the limited time available, if very careful rules are laid down and observed in the recording of this species and other small plants, so that subjective judgment of such terms as "dense" "scattered" "sparse" is eliminated as much as possible. As the figures for *Polytrichum* are not as reliable as those of other plants, they are shown separately.

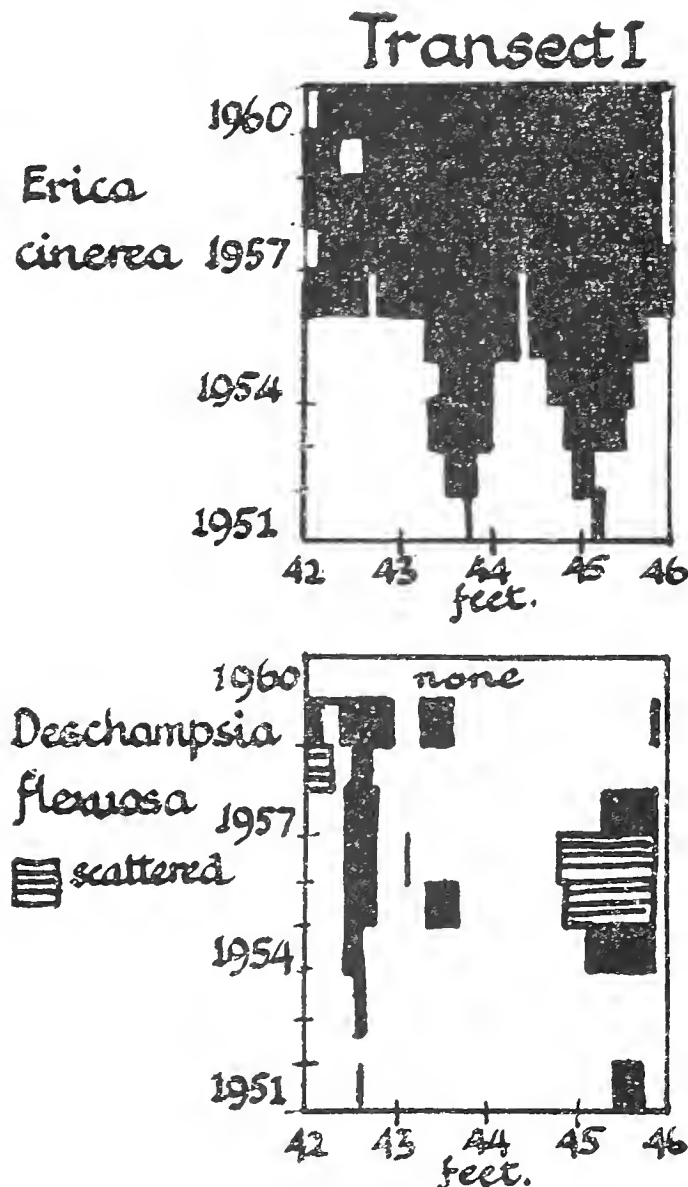


FIGURE 1. A 4-foot specimen length of the 66 feet transect diagrams for two species. It shows the ultimate ascendancy of *Erica* over *Deschampsia* in this stretch, after some years of co-existence.

Transect I

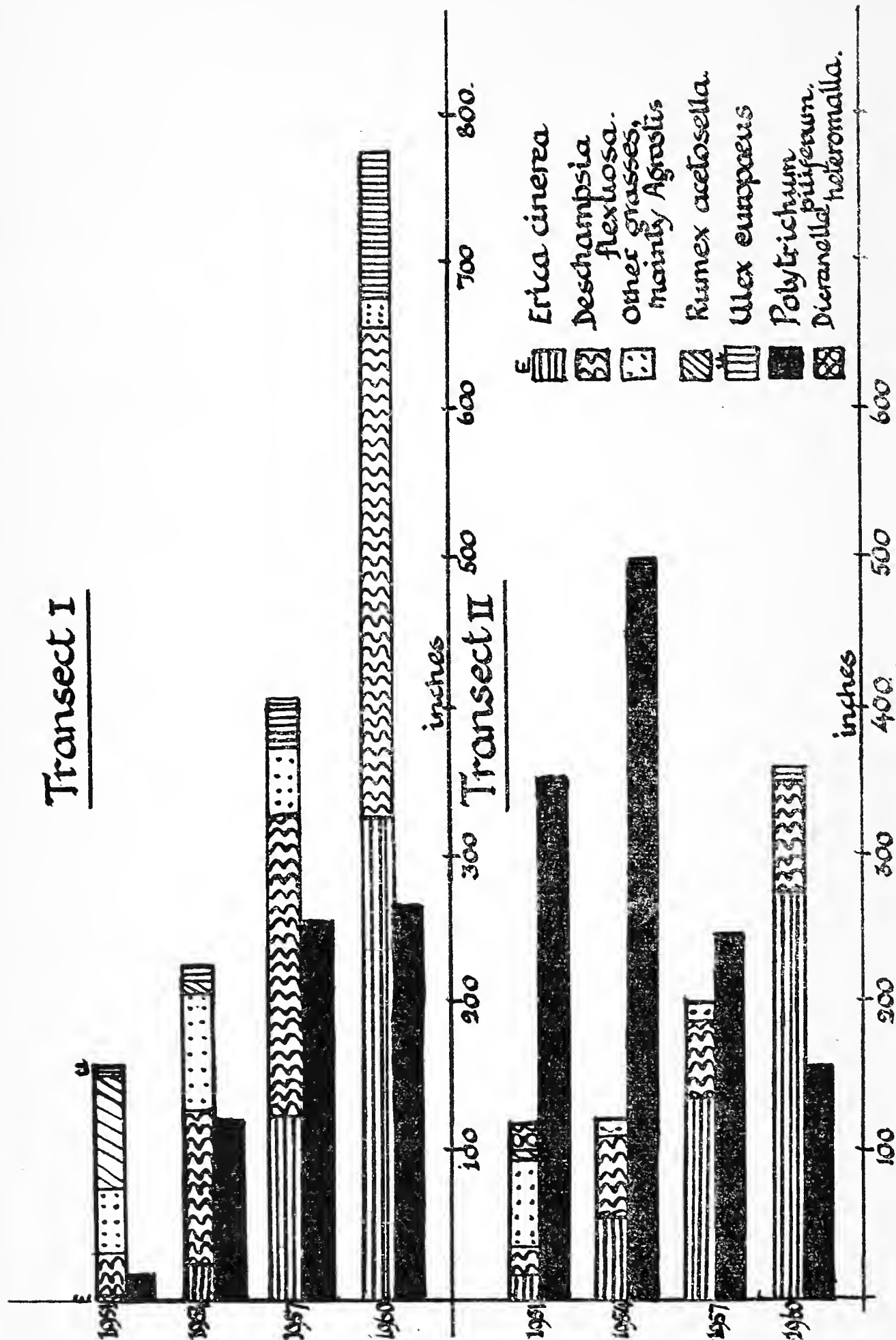


FIGURE 2. Showing the extent and composition of the coverage in the two transects at 3-yearly intervals. (The two areas should not be compared with one another. See Section 5.)

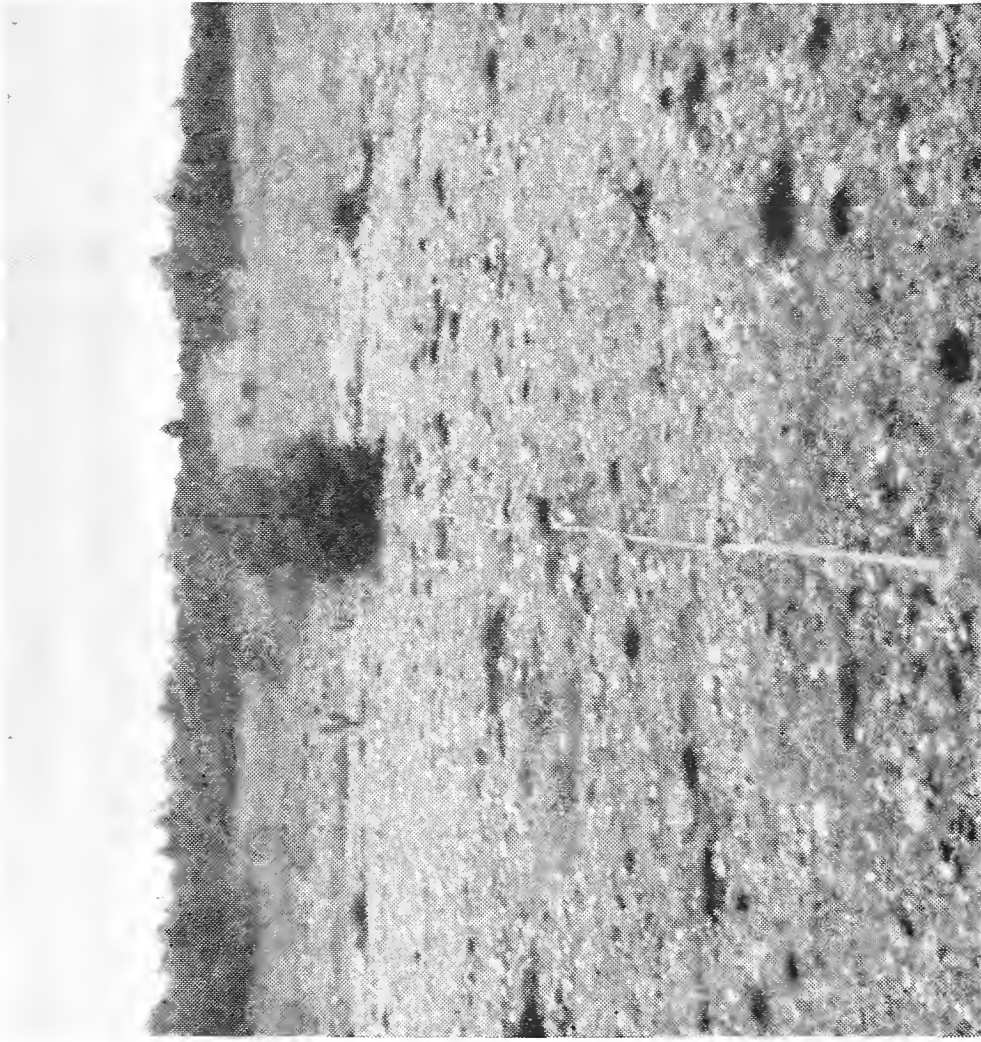


Photo by P. W. E. Currie

A. From N. end looking S.E. to Zero Birch. September, 1951

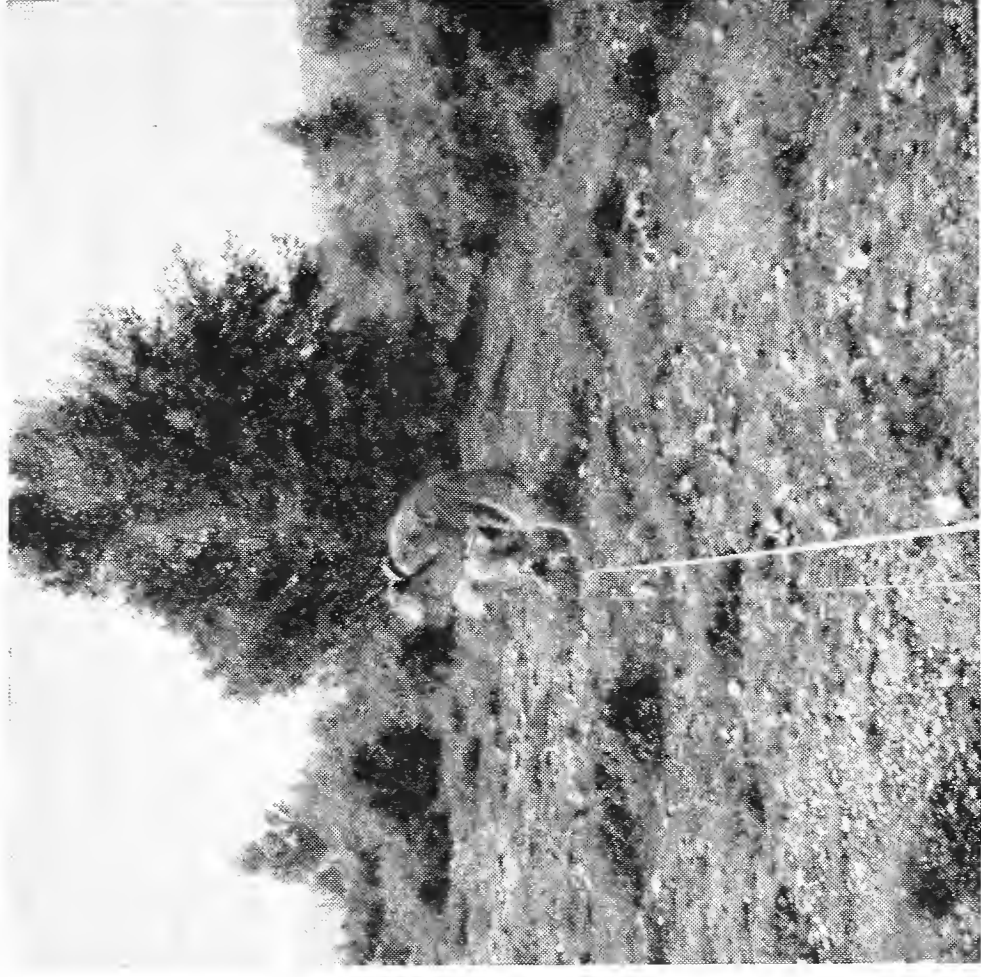


Photo by C. P. Castell

B. From S. end looking N.W. to Terminal Birch. September, 1960.

TRANSECT I

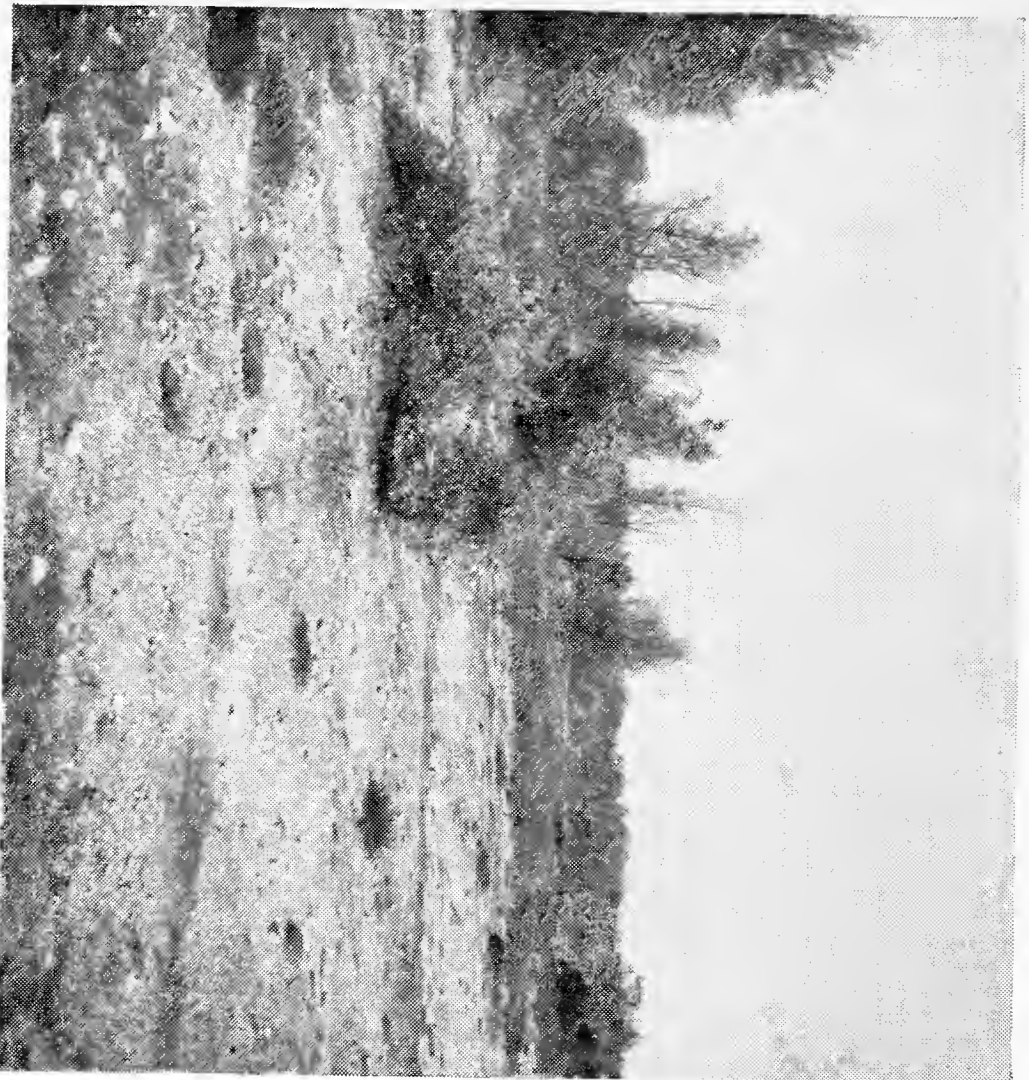


Photo by C. P. Castell

A. From S. end looking N.E. to Zero Birch. Small birches at 40 ft. from zero. September, 1956.



Photo by C. P. Castell

B. From birches at 40 ft. looking N.E. to Zero Birch. September, 1960.

TRANSECT II

The field records were afterwards translated into diagrammatic form. Each species was now recorded separately along the transect on a scale of 1 inch to 1 foot on quarter-inch squared paper, starting at the bottom of the page and working upwards in succeeding years. Fig. 1 shows a specimen stretch 42 ft. to 46 ft. (on a smaller scale), for two species, in which a "struggle" has taken place between them, with *Erica* supreme in 1960.

INTERPRETATION OF RESULTS

The term "coverage" has a different significance in the two transects, since one is a belt and the other linear. Thus Fig. 2 should not be taken to indicate that Area I is being more rapidly colonized by plants (other than *Polytrichum*) than Area II. All that is claimed for the coverage figures is that they give an indication of the relative abundance of the species present and the progress of each species from year to year.

In transect I, however, since a plant can occupy from 0 inches to 6 inches in width of the transect, if that plant is of frequent occurrence it is likely to occupy half the width of the transect on the average. Thus the coverage, although a linear measurement along the tape, will probably be proportional to the areas occupied by the plants, in the case of the common species.

The table of percentage coverage reveals the dominant plant for each year. A fall in its *percentage* coverage may, of course, coincide with a considerable extension of a species over the transect. Fig. 2 shows the extent as well as the composition of the flora at three-yearly intervals.

Fig. 3 shows the progress of the most common species (other than *Polytrichum*) of both areas, and Fig. 4 that of *Rumex acetosella*, the dominant plant of Transect I in 1951, and the increase of *Ulex europaeus* in that area. (These two plants have behaved in the same way in Area II, but their coverage is small there).

COMPARISON OF THE AREAS.

A. The points of similarity of the two areas:—

- (i) By 1960, *Erica cinerea* has become the dominant species and for the first time in that year its coverage is greater than that of *Polytrichum*. In Transect I, however, *Deschampsia flexuosa* is co-dominant at present, and this species is also increasing. It is interesting to note how long *Erica*, which is a conspicuous constituent of the vegetation in neighbouring areas, has taken to reach this status (see Table).
- (ii) In each area grasses other than *Deschampsia* show a steady decline (Fig. 3).
- (iii) *Rumex acetosella* died out after five and three years respectively in the two areas (Table, Fig. 4).
- (iv) The six commonest species (listed in Table) are the same for both, and those which were most common in 1951 (*Rumex* and *Agrostis* respectively) are now extinct or negligible.

B. The differences in the two areas:—

- (i) *Polytrichum piliferum* was, until 1958, much more common in area II than Area I. Whereas in Area II it has tended to decline though with fluctuations, in Area I it steadily increased until 1959.

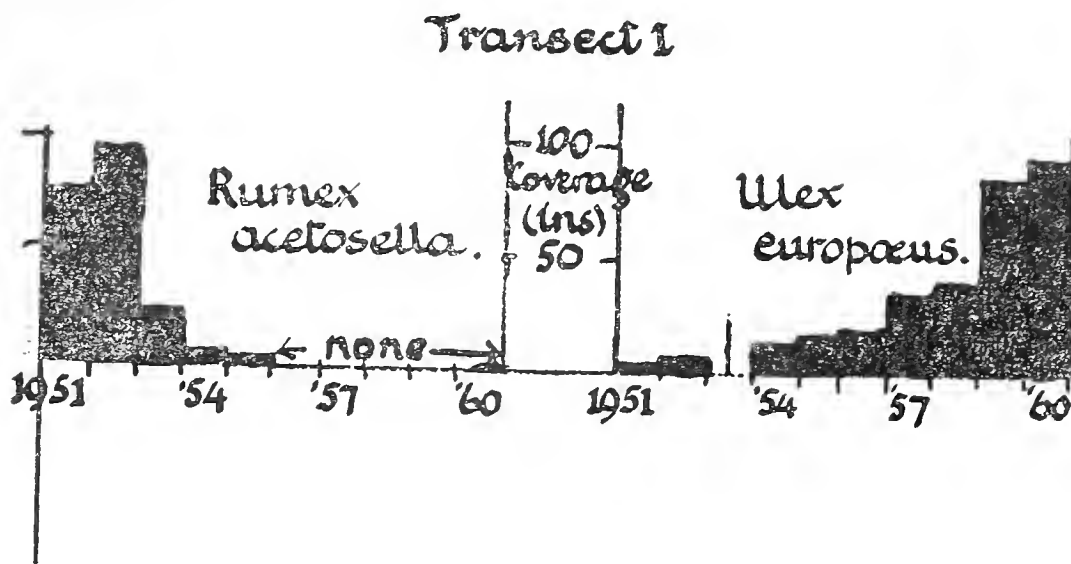


FIGURE 4. The progress of *Rumex acetosella* (originally dominant) and *Ulex europaeus* in transect I.

- (ii) The rise of *Ulex* in Area I is more rapid than in Area II, where it is now just beginning to obtain a foothold. This is probably because Area I is situated in a part of the heath where *Ulex* is more abundant.
- (iii) *Deschampsia flexuosa*, after an early rapid increase, shows a rate of increase considerably less than that of *Erica* in Area II. In Area I it increased more rapidly than *Erica* at first, but the two plants now have almost equal status in that area.

During the course of the Survey, attempts were made, with inconclusive results, to estimate the percentage of ground still bare of vegetation by a study of the transects. Early in April, 1961, an estimate of bare ground, except for the occasional lichen, was made for each area by means of 22 quadrats each a yard square. The following results were obtained:

Along Line of Transect: Area I 44%, Area II 54%

Over Remainder of Area: Area I 48%, Area II 57%

In neither area could the transects be placed centrally because of the necessity of selecting isolated birch trees as landmarks and zero points for the transects.

The greater coverage on the transects in both areas, if the difference is significant, is thus probably accounted for by encroachment of plants from the margins of the areas.

FURTHER NOTES ON THE SPECIES

Polytrichum piliferum. In Area I the check to its increase appears to be due to displacement by *Erica*. (This can be seen by studying the diagrams of which Fig. 1 is a specimen). In Area II the decline is also partly due to this cause, apparently, but there are patches where the moss died without being displaced or overshadowed by other plants.

Polytrichum favours the hollows of Area II which are more sandy and probably damper than the ridges.

OTHER SPECIES PRESENT ON THE TRANSECTS

Betula pendula (Silver Birch) .. I and II 1951-60
(as seedlings, or roots and over-
hanging branches of trees)

TABLE

Transect I
Transect II

Year 19	51	52	53	54	55	56	57	58	59	60	51	52	53	54	55	56	57	58	59	60
(a) Total coverage (inches) excluding <i>Polytrichum</i> and other mosses and lichens	146½	239	—	223½	293	412	409	475	600½	773	100	94	62½	120	155½	190½	199½	243½	321*	362½
(b) Percentage of total coverage occupied by:—																				
<i>Erica cinerea</i> (Heath)	1	3	—	10	12	17	30	33	39	43	17	19	17	44	55	56	68	76	73	77
<i>Deschampsia flexuosa</i> (Wavy Hairgrass)	20	28	—	47	58	62	49	53	43	42	19	39	39	47	28	32	25	23	25	20
Other grasses mainly <i>Agrostis</i> spp. (Bent-grass)	24	25	—	36	24	16	11	5	4	3	58	39	42	9	17	13	7	1	1	—
<i>Rumex acetosella</i> (Sheep's sorrel)	53	40	—	2	1	—	—	—	—	—	6	2	1	—	—	—	—	—	—	—
<i>Ulex europaeus</i> (Gorse)	2	3	—	5	5	5	9	8	14	12	—	—	—	—	—	—	<1	1	—	1
Other species	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1*	2
(c) Coverage of <i>Polytrichum piliferum</i> (Hair moss) as percentage of total for other species	10	20	—	50	80	50	60	80	60	30	300	550	900	400	300	200	120	100	120	50

The plant with the highest percentage coverage in a given year is referred to as the dominant species for that year.
The estimation for *Polytrichum* is given separately, and as a rough approximation only, as the records for this species are more liable to error.
* Indicates that 79 inches of overhanging birch have been omitted from the total coverage, as being a large fortuitous factor affecting only that year's result.

<i>Luzula campestris</i> (Field woodrush)	I	1955 (2")-1960 (6")
<i>Carex</i> sp. (Sedge)	I	1954, 1956
<i>Sagina procumbens</i> (Pearlwort) ..	I	1951
<i>Galium saxatile</i> (Heath Bedstraw) ..	I	1957, 1960
	II	1951
<i>Hypochoeris radicata</i> (Cat's Ear) ..	I	1960
<i>Rumex</i> sp. (Dock)	I	1960
<i>Calluna vulgaris</i> (Heather)	II	1960
Mosses (fragmentary records)		
<i>Dicranella heteromalla</i>	I and II	1951, 1957, 1960
<i>Ceratodon purpureus</i>	I	1967
<i>Pohlia nutans</i>	I	1957
<i>Bryum</i> sp.	I	1957

On the whole, the flora of Area I seems to have been more varied than that of II, if that of the transects is a reliable guide.

Lichens and algae have been excluded from the Survey except that in 1954-5, J. R. Laundon made a list and the following is a brief summary.

Lichens	<i>Rhizocarpon</i> sp. on stones	Transects I and II
	<i>Lecidea erratica</i> (stones)	Transect I
	<i>Baeomyces rufus</i> (sand)	Transect II
Alga	<i>Zygonium ericetorum</i> (sand)	Transect I

ACKNOWLEDGMENTS

It would be impossible to name here all those who have taken part in this survey over the ten year period. We thank them all for their help, but we must give special thanks to the following: G. Conway, Miss G. W. Dalby, A. W. Jones and G. F. Lawrence, for their valuable help in naming and recording plants in the field. Miss Dalby also produced, in 1957 for the Society's Centenary Exhibition, an excellent exhibit which demonstrated, in a most attractive way, the results of the survey to members and other visitors. Our thanks are also due to R. Cosser and P. W. E. Currie for photographic records and to Dr. G. Beven and W. D. Melliush for transport and other help.

REFERENCE

BURGES, A., 1960, Time and Size as Factors in Ecology. *Journal of Ecology*, 48, 273.

The Vegetation of the South Norwood or Elmers End Sewage Works

By A. W. JONES

GENERAL REMARKS

TOPOGRAPHY

The South Norwood Sewage Works lie immediately west of Elmers End Station on the boundary of Kent and Surrey, grid ref. TQ (51) 350680. A map of the area is given in this paper. For recording purposes the area has been divided into 13 divisions (lettered A-M) usually bounded by a track or other clear line of demarcation. In the systematic list the name of each of the 171 plants is followed by the total number of divisions from which it was recorded together with the letters of the divisions.

The survey area covers 101 acres. As will be seen from the map certain allotments, sports fields and dumps (basically of war damage materials) which were formerly used for sewage disposal purposes, have been excluded from the survey.

The works were established 80 years ago and originally also covered an area to the east of the main railway.

The Kent/Surrey boundary runs just inside the north-east of CD and E so that F-M are wholly in Kent and A and B wholly, and C, D and E mostly, in Surrey.

WORK DONE ON VISITS

The records were made in the period October 1958 to September, 1960. During the visits plants were listed for their frequencies in each habitat in each division.

ABBREVIATIONS

The following abbreviations for frequencies have been used:—

r	rare	a	abundant
l	local(ly)	v	very
o	occasional	d	dominant
f	frequent	c	co-

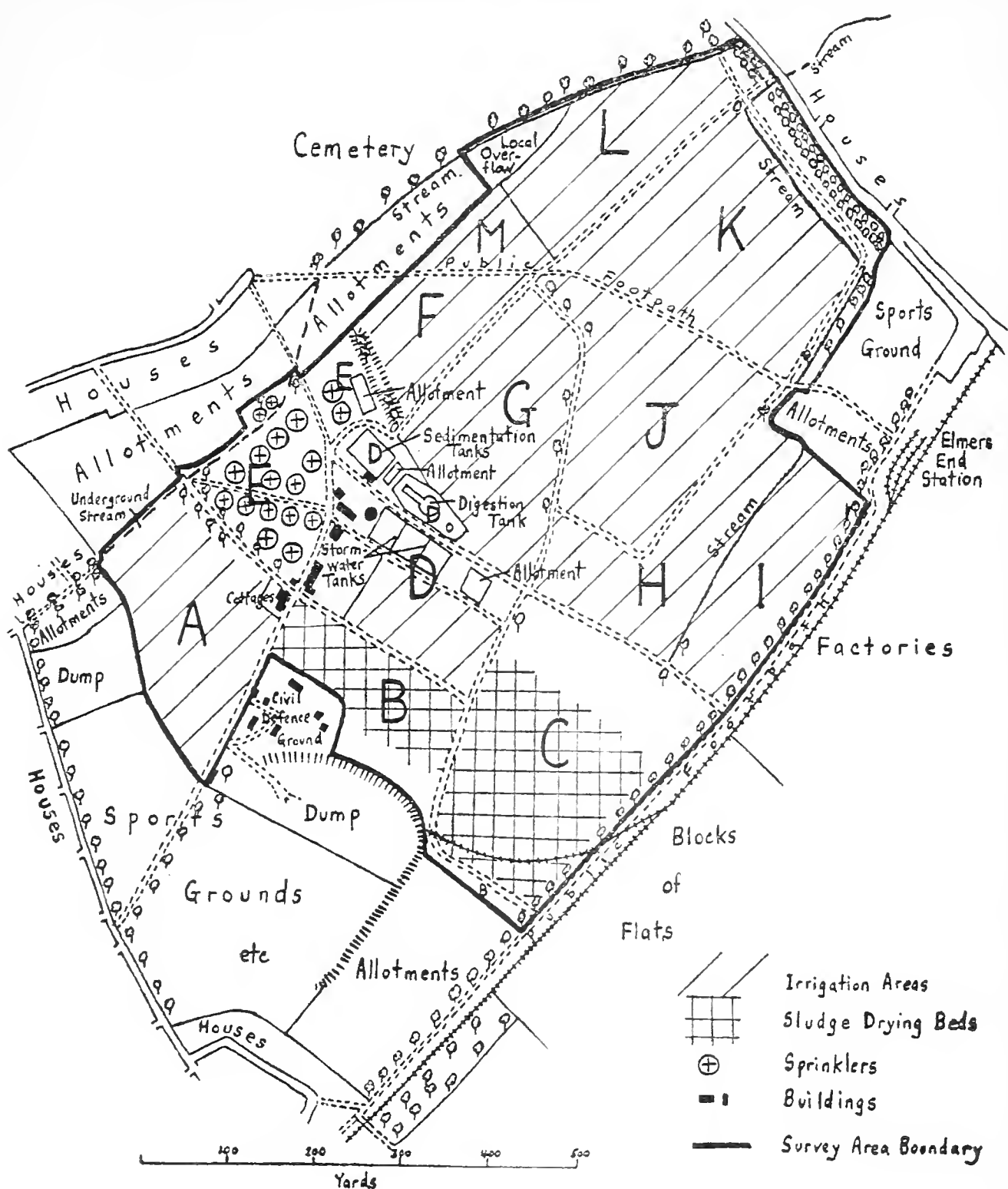
Where no frequencies are shown in the systematic list this indicates that single plants or patches were noted in the habitat and/or division. Where a plant occurs in only a few divisions the frequency given is that within these divisions and not the survey area as a whole.

DESCRIPTION OF THE PURIFICATION WORKS

The purification of sewage may be divided into two distinct phases, namely:

- (1) the physical and mechanical removal of suspended solids from the crude sewage, and the disposal of the removed solids;
- (2) the biological purification of the suspended solid free sewage.

The sewage enters the purification works at the inlet in D, where it is passed through the "Screens" and the "Detritus" tanks. The screens, consisting of parallel bars immersed in the sewage flow, retain the large suspended solids, e.g., rags, paper, pieces of wood, etc., together with a large proportion of the faeces. The detritus tanks allow the heavy suspended matter, e.g., sand, gravel, bricks, etc., to settle on to the floor of the tank. The solids thus retained are removed from the screens and the



SOUTH NORWOOD SEWAGE WORKS

detritus tank by manual and mechanical means, and finally buried along with a heavy dose of lime in trenches dug in the north of C and occasionally in D.

The sewage which still contains much fine suspended matter is distributed between three large rectangular "Sedimentation" tanks of total capacity 600,000 gallons. By virtue of the consequent reduction in the forward velocity of the liquid, the fine suspended solids settle on the floor of the tanks, forming a thick sludge.

The sedimentation tanks are emptied and cleaned weekly, the sludge being pumped into the "Digestion" tank. This is a deep circular tank provided with a floating roof and ancillary plant for circulation and

heating the sludge. The air is excluded from the tank and the sludge is maintained at 85-95°F. Under these conditions anaerobic bacterial decomposition of the sludge occurs, producing large volumes of "Sludge gas", and a residual sludge which is more easily dried than the original sludge. The sludge gas, consisting of 70% by volume of methane, is used for the heating of the sludge and for the heating of nearby buildings. After 40 days' digestion, the residual sludge is pumped on to the sludge drying beds in the areas B and C. Here the sludge is dried under atmospheric conditions until of spadeable consistency. The dried sludge is then removed and mixed with grass to produce a compost, which is sold for use on parks, gardens and lawns, etc.

The supernatant liquid from the sedimentation tanks is distributed over the surface of the "Biological filters" which are located in the area E. These filters are beds of media, 6 feet deep, provided with a rotating distributor. The filter is the habitat of large numbers and varieties of aerobic organisms, e.g., *Protozoa*, *Bacteria*, *Diptera* larvae. In consequence of the biological activity, purification of the applied liquid occurs, the impurities being broken down into harmless constituents, e.g., water, carbon dioxide, nitrates, etc.

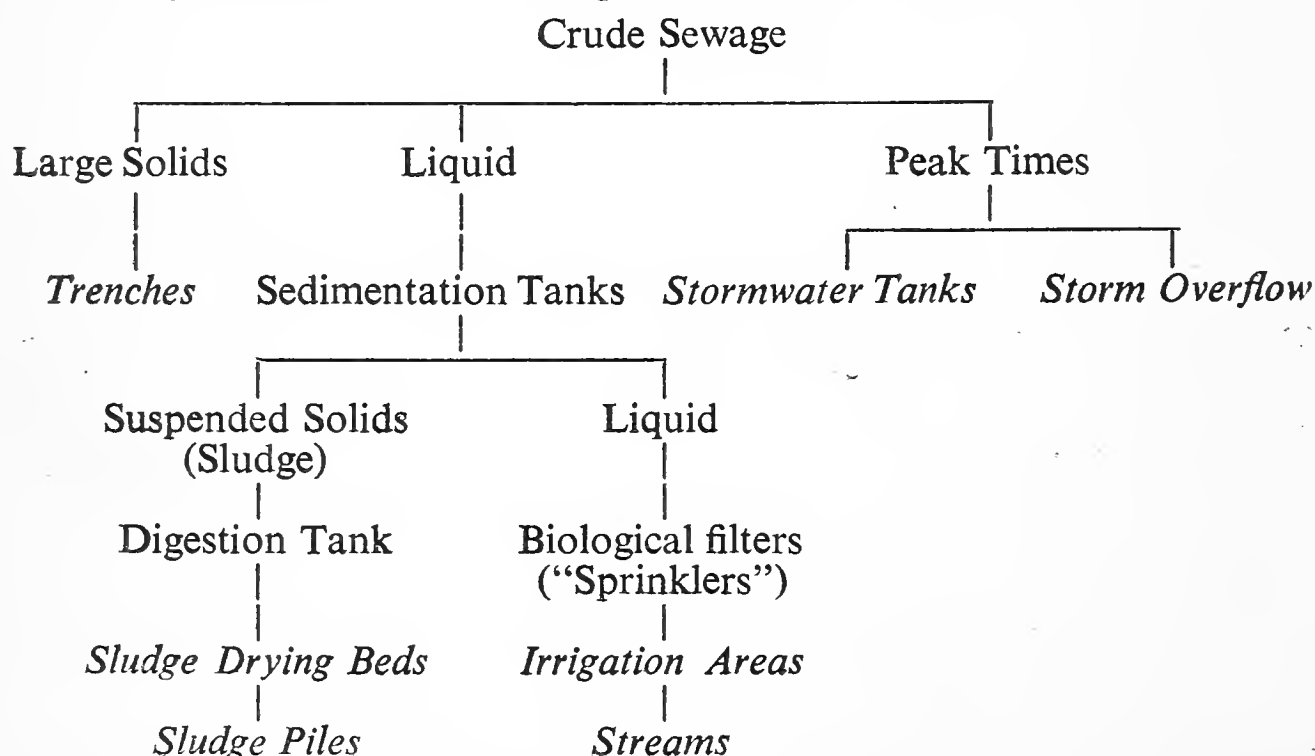
The effluent from these filters, containing suspended solids in the form of humus, is mixed with a proportion of effluent direct from the sedimentation tanks and dispersed over grassland, on a broad irrigation system. The effluent from these fields, is discharged into the Chaffinch Brook, and ultimately into the River Thames at Deptford.

The irrigation fields are operated on a rotation system, and are ploughed and harrowed when conditions permit. The average volume of liquor applied per annum is equivalent to a depth of 60 feet over the surface. The irrigation areas were originally planted with *Lolium multiflorum* (Italian Rye-grass).

During times of storms, stormwater by-passes the works and flows through the stormwater tanks in the area D. Other untreated stormwater may also gain access to the marshy area in the west end of L.

THE HABITATS

It may be useful to show the processes diagrammatically thus:—



The habitats where flowering plants grow are in italics and are dealt with below.

IRRIGATION AREAS

Most of the liquid irrigated over these grassland areas has passed through the "sprinklers" and the process is for the final deposit of suspended solids.

Sixty-five species were recorded from the irrigation areas and their edges.

The chief constituents of the flora were:—

Dominant:

	A	D	F	G	H	I	J	K	L	M
<i>Lolium multiflorum</i>	cd	cd	d	*d	†cd		cd	cd	cd	cd
<i>Poa trivialis</i>	cd			d	†cd	d	cd	cd	cd	cd
<i>Agropyron repens</i>		cd								
<i>Phalaris arundinacea</i>				‡d						

* at edges, † north half, ‡ south half

Others:

- va *Rumex obtusifolius*
- a *Polygonum persicaria* and *Urtica dioica*
- la *Ranunculus repens*
- o *Ranunculus sceleratus*, *Rorippa islandica*, *Epilobium hirsutum*, *Glyceria fluitans* s.l.

At Edges:

- va *Urtica dioica*
- vf *Armoracia rusticana*, *Epilobium hirsutum* and *Ranunculus repens*
- f *Lamium album* and *Stellaria media*
- lf *Anthriscus sylvestris*, *Arrhenatherum elatius*, *Chenopodium album*, *Agropyron repens* and *Galium aparine*
- o *Cirsium arvense*, *C. vulgare*, *Alliaria petiolata*, *Lamium purpureum* and *Bromus sterilis*.

SLUDGE DRYING BEDS

The sludge from the digestion tank is pumped on to these beds which are fields partitioned into small areas by means of earth banks. The dried sludge is later removed to the sludge piles, the covering vegetation being thus almost completely cleared so that mainly annuals are to be found on the beds.

Sixty-one species were recorded from the sludge drying beds and their edges.

The chief plants were:

- va *Lycopersicon esculentum*
- a *Chenopodium album*, *C. ficifolium*, *Urtica urens* and *Senecio vulgaris*
- la *Stellaria media*, *Poa annua* and *Atriplex hastata*
- lf *Capsella bursa-pastoris* and *Poa trivialis*
- o *Polygonum aviculare* s.l., *P. persicaria*, *Rumex obtusifolius* and *Sonchus oleraceus*

At edges:

- f *Urtica dioica*
- la *Agropyron repens*
- lf *Galium aparine*
- o *Lactuca serriola*

The seeds of *Lycopersicon esculentum* settle in the sedimentation tanks and are removed as part of the sludge, surviving the 40 days in the digestion tank at a temperature of 85-90°F. Few seeds pass from the sedimentation tanks to the sprinklers and plants were recorded only once from an irrigation area and then as local.

An important characteristic of the Sludge Drying Beds, the Stormwater Tanks and the Sludge Piles is the heavy concentration of nitrogenous material always attractive to the *Chenopodiaceae* and *Polygonaceae*.

STORMWATER TANKS

These are large shallow concrete tanks into which stormwater overflows. When the stormwater recedes most of the pre-existing vegetation appears to have been killed and a deposit is left. This deposit, however, is quickly overgrown with vegetation so that the flora fluctuates markedly in character. The deposit in the tanks is cleared out from time to time.

Thirty-one species were recorded.

Abundant plants at one time or another were *Stellaria media*, *Chenopodium polyspermum*, *C. album*, *Potentilla reptans*, *Lycopersicon esculentum*, *Senecio vulgaris* and *Lolium multiflorum*.

On one occasion in 1958 *Potentilla reptans* was spreading rapidly by stolons in every direction but the following year the plant was only noted as present, and in 1960 as very local.

STORM OVERFLOW

Stormwater sometimes gains access to a marshy area in the west of L referred to in this paper as the Storm Overflow.

Fourteen species were recorded.

The area is a tangled mass of *Urtica dioica* and *Rumex obtusifolius* with *Epilobium hirsutum*, *Polygonum persicaria* and *Bidens tripartita* also abundant. A large clump of *Iris pseudacorus* also occurs and possibly other semi-aquatics, as part of this marshy area could not be reached even in the dry summer of 1959.

SLUDGE PILES AND COVERED-IN TRENCHES

The dried sludge removed from the sludge drying beds is mixed with grass and heaped into piles for composting. A flora quickly develops on these piles and again on the site when the pile is cleared away.

The faeces and other solids are buried in trenches and covered with earth and a wasteland flora develops on top.

The full significance of the difference between the two habitats was not appreciated whilst recording and records are not therefore differentiated. In the systematic list with few exceptions all records have been referred to the sludge piles as the trenches were floristically poor. Fifty-two species were recorded from these habitats.

The sludge piles were largely covered with *Chenopodium album* and *C. ficifolium*, with also frequent *Stellaria media*, *Atriplex hastata*, *Polygonum aviculare* s.l., *Urtica urens*, *Lycopersicon esculentum*, *Senecio vulgaris*, *Matricaria recutita* and *Bromus sterilis*.

Few records were made from the trenches but along one *Phalaris canariensis* was abundant on the covering soil. The alien *Vicia panonica* Crantz var. *purpurascens* (D.C.) Boiss was also seen.

STREAMS

There are two main streams, both flowing eastwards. One in the north is fed by a spring and water from roads, and this runs underground

through A and E. This underground part was put in covered concrete conduit only during 1960 when a wasteland flora developed on the site. The source of the other main stream in the south is unknown. Both join in the northern tip of K before leaving the works. The southern stream has an overflow in the south-east corner of K.

Thirty-six species were recorded along streams and ditches.

Because the streams and ditches run for the most part in concrete channels practically nothing grows in them although *Rorippa islandica* had its roots in the water.

The banks largely provide a rough-ground habitat and *Anthriscus sylvestris* and *Heracleum sphondylium* are characteristic.

We now come to habitats which are not basically part of the Sewage Works, i.e., Rough Ground, Waste Places, etc., and Wooded Strips.

ROUGH GROUND, WASTE PLACES, ETC.

Rough Ground is here defined as grassy places in the open other than irrigation areas; Waste Places as rather bare areas particularly where recently disturbed. Plants were also recorded from the small allotments within the survey area, a small lawn, tracks, by gardens of a pair of cottages and the site of the stream in A and E. The area around the "sprinklers" is grassed over and periodically mown and is classified as rough ground in this paper.

Altogether 118 species were recorded in these habitats.

Taking the rough ground separately (and this is grassy by definition) the frequent grasses are *Dactylis glomerata*, *Lolium multiflorum*, *Alopecurus pratensis*, *Bromus sterilis*, *Poa pratensis* s.l., and *P. trivialis* with appreciable quantities of *Agropyron repens*, *Poa annua*, *Bromus mollis* s.l., and *Arrhenatherum elatius*. Of the other plants *Anthriscus sylvestris*, *Heracleum sphondylium*, *Urtica dioica*, *Lamium album* and *Taraxacum* sp. are all frequent.

Of the various habitats in general the following species are also characteristic:—*Ranunculus repens*, *Capsella bursa-pastoris*, *Armoracia rusticana*, *Stellaria media*, *Chenopodium album*, *Trifolium repens*, *Potentilla reptans*, *Polygonum aviculare* s.l., *Rumex obtusifolius*, *Urtica urens*, *Glechoma hederacea*, *Plantago major*, *Senecio vulgaris*, *Artemisia vulgaris* and *Cirsium arvense*.

WOODED STRIPS

The only important trees and shrubs occurring on the works are those making up the wooded strips (these are never more than four lines of trees and usually a single line):—*Pinus* sp., *Acer pseudoplatanus*, *Ulmus glabra*, *U. procera*, *Populus* cf *nigra* and *P. nigra* var. *italica* Du Roi. Most of these trees are obviously planted and under 50 years old. *Sambucus nigra* is frequent in the wooded strips and occasional elsewhere. *Rubus fruticosus* s.l. is occasional. Fifteen other trees and shrubs were recorded over the survey area.

Of the herbs there are abundant *Anthriscus sylvestris* and *Urtica dioica* and frequent *Heracleum sphondylium*, *Alliaria petiolata* and *Arrhenatherum elatius*. Thirty-two species of herbs altogether have been recorded but the only hedgerow/woodland species on the works (although not confined to that habitat) are perhaps *Alliaria petiolata*, *Anthriscus sylvestris*, *Heracleum sphondylium*, *Bryonia dioica*, *Lamium album*, *Glechoma hederacea* (on the works chiefly a plant of rough ground),

Lapsana communis, *Arum maculatum*, *Endymion non-scriptus* and *Bromus ramosus*. The woodland element is thus very poor and certainly indicates that the area was not wooded before the works were instituted about 80 years ago.

PLANTS ASSOCIATED WITH WET PLACES ON THE WORKS

A considerable part of the survey area consists of irrigation areas over which water frequently flows (60 foot deep total dosage per year). The depth of water and mud prohibits examination when in use except perhaps warily in wellington boots. The writer examined them only when dry and parts of K were always found to be too wet to be accessible.

The species particularly associated with the irrigation areas and streams, etc., are listed below in the categories recognized by the writer, Jones (1960), for Bookham Common. He concluded that many of the plants normally associated with streams, ponds, and marshes were there not primarily because of the aquatic habitat but because of the bare or disturbed ground present, e.g., mud or banks disturbed by a stream in flood.

1. Aquatics and Semi-aquatics.

Ranunculus sceleratus
Bidens tripartita
Iris pseudacorus
Glyceria fluitans s.l.
Phalaris arundinacea

These are few due to the periodical ploughing of the irrigation areas. *Bidens tripartita* and the larger clump of *Iris pseudacorus* are in the storm overflow which the plough does not reach. *Phalaris arundinacea*, Mr. Hodgson informs the writer, was never planted and has been gradually increasing in extent over the last 30 years. It now occupies completely the field constituting the south part of G but only a few plants occur in the north. A possible explanation may be that it appears to spread solely by what Clapham, Tutin and Warburg (1952) call far-creeping rhizomes, which are not ploughed up in the south but are in the north.

2. Plants Usually Associated with Flowing or Standing Water.

Barbarea vulgaris
Rorippa islandica
Filipendula ulmaria
Epilobium hirsutum
Polygonum amphibium
Salix alba
S. fragilis
S. viminalis
S. cinerea
Scrophularia aquatica

Epilobium hirsutum is very frequent at the edges of irrigation areas occupying a very similar habitat to that at Bookham—a semi-wasteland habitat at edges of water.

Salix fragilis, *S. viminalis* and *S. cinerea* all came up apparently from seed on a partially dried-out surface of a sludge drying bed in C. *Salices*, as at Bookham, often germinate on mud—here of course they did not reach their second year. *S. alba* and *S. fragilis* trees also occur elsewhere but perhaps planted.

3. Plants Often Associated with Water.

Ranunculus repens
Cardamine pratensis
C. flexuosa
Epilobium cf. *obscurum*
Solanum dulcamara
Juncus bufonius
J. effusus

On the works, however, *Solanum dulcamara* and *Juncus bufonius* were not recorded in any aquatic habitats.

Only two single plants of *J. effusus* were noted—no doubt ploughing of the irrigation areas kills this species but it is surprising that the plant was not found in dryer places which it will often tolerate.

4. Perennial and Biennial Plants of Waste Places

Armoracia rusticana
Alliaria petiolata
Potentilla reptans
Anthriscus sylvestris
Heracleum sphondylium
Rumex obtusifolius
Urtica dioica
Calystegia sepium
Lamium album
Lolium multiflorum
Poa trivialis
Dactylis glomerata
Agropyron repens
Arrhenatherum elatius

It is interesting to compare these with the Bookham list:—

- (a) Four of the species were pointed out as being particularly tolerant of flowing or standing water:
- (i) *Anthriscus sylvestris*, often found in abundance along streams in Surrey as it is on the works as well as locally at the edges of the irrigation areas.
 - (ii) *Alliaria petiolata*, as *Anthriscus sylvestris* but to a lesser extent.
 - (iii) *Urtica dioica*, frequent along streams and at edges of ponds at Bookham, is very abundant at the edges of the irrigation areas.
 - (iv) *Calystegia sepium*, although local at edges of irrigation areas, is again associated with *Urtica dioica* over which it climbs.
- (b) Also recorded at Bookham from semi-aquatic habitats were:
- (i) *Lamium album*, only recorded from stream-banks for which it does appear to have a slight bias generally—on the works it is frequent at the edges of the irrigation areas.
 - (ii) *Potentilla reptans* and
 - (iii) *Heracleum sphondylium*, as at Bookham, both had a slight preference for the proximity of water on the works.
 - (iv) *Rumex obtusifolius*, only recorded by a few streams and one hollow at Bookham, is however, very abundant in the irrigation areas on the works. *R. crispus* often associated with *R. obtusifolius* elsewhere was recorded only twice for the works and that was from rough ground.

- (v) *Dactylis glomerata*, recorded from one minor pond and a damp hollow at Bookham, is rather more tolerant of standing or flowing water on the works where it is local in and around edges of irrigation areas.

Armoracia rusticana is elsewhere, in Surrey, mostly found near houses or on railway banks, etc., and scarcely ever associated with an aquatic habitat, but on the works it is very frequent at the edges of the irrigation areas as well as occurring in rough ground generally. The rights to dig the plant are sold every year or so but obviously the diggers leave the smaller roots and these multiply by stolons to come up as strong as before.

Lolium multiflorum has long been recognized as the most suitable plant for irrigation areas, Rideal (1900) quoting that "it absorbs the largest volume of sewage". It was therefore extensively planted in the irrigation areas (although no plantings have been effected in the last 10 years on the works).

Poa trivialis, co-dominant in most of the irrigation areas has apparently never been planted and must have partially ousted *Lolium multiflorum* and perhaps is still doing so. It is a very luxuriant form although this may be due to the nourishment it receives. Apart from normally being a wasteland plant in Surrey it is often quite frequent in bare parts of woods.

Agropyron repens (locally frequent at edges of irrigation areas and co-dominant in the irrigation area in D) and *Arrhenatherum elatius* (locally frequent at edges of irrigation areas) are like the three preceding species not normally associated with aquatic habitats but their distribution on the works suggests they have a high tolerance to standing or flowing water. It must be remembered that the irrigation areas are not continuously worked.

5. Annual Plants of Waste Places.

Stellaria media

Chenopodium rubrum

Polygonum aviculare s.l.

P. lapathifolium

P. persicaria

Galium aparine

Polygonum persicaria at Bookham is tolerant of standing or flowing water; on the works it develops this characteristic to an extreme, being so abundant in the irrigation areas as sometimes to make them look reddish-brown in the autumn.

P. lapathifolium is much less tolerant and is decidedly local on the works.

As at Bookham *Galium aparine* is tolerant of standing or flowing water and commonly climbs over *Urtica dioica*.

In Surrey *Chenopodium rubrum* not uncommonly appears on dried-up pond-beds as occasionally at Bookham.

NOMENCLATURE

Dandy (1958) has been followed for scientific names unless otherwise indicated and chiefly Johns (1905) for English names.

ACKNOWLEDGMENTS

Thanks are due to Croydon Corporation for permission to visit the area. The central staff of the various Croydon works, E. Hodgson

(manager) and B. R. Edmondson (chief chemist) have afforded much assistance on the technical side. Mr. Edmondson, it must be mentioned, completely re-wrote the account under the heading "Description of the Purification Works". Messrs. Bashford and Messer of the South Norwood works also gave me information.

C. P. Castell kindly read the manuscript and made many useful suggestions which have been carried out.

SYSTEMATIC LIST

- Equisetum arvense*, Field Horsetail. 2 CI. I, wooded strip lf; C, rough ground.
Pteridium aquilinum, Bracken. 1 D. Rough ground.
Dryopteris filix-mas, Male fern. 1 D. Rough ground.
Pinus sp., Fir. 3 IKL. Planted lines of trees along north-east sides of K and L, and south-east side of I.
Ranunculus acris, Meadow Buttercup. 5 GI-L. Rough ground l; edges of irrigation areas vr.
R. repens, Creeping Buttercup. 12 AC-M. Most irrigation areas la and often very luxuriant; rough ground and edges of irrigation areas vf; stormwater tanks; lawn.
R. sceleratus, Celery-leaved Crowfoot. 3 HKL. H, K, irrigation areas la; storm overflow.
Papaver somniferum, Opium Poppy. 2 CD. C, sludge pile; D, garden.
Fumaria sp., Fumitory. 1 C. Edge of irrigation area.
Brassica cf. *oleracea*, Cabbage, etc. 4 B-E. Single plants o; sludge drying beds, edges of irrigation areas, wastes, rough ground, etc. Probably associated with existing or past sludge drying beds.
Sinapis arvensis, Charlock. 2 AC. Rough ground, wastes, etc., l.
Raphanus raphanistrum, Wild Radish. 1 C. Sludge pile, white-flowered.
Coronopus squamatus, Swine's-cress. 1 C. Sludge pile.
Cardaria draba, Whitlow Pepperwort. 4 B-E. Tracks, rough ground, etc.; l.
Thlaspi arvense, Penny Cress. 1 B. Sludge pile.
Capsella bursa-pastoris, Shepherd's Purse. 6 B-G. Sludge drying beds, wastes, tracks, rough ground, etc.; o.
Armoracia rusticana, Horse-radish. 13. Edges of all irrigation areas, f; rough ground, etc., o; stormwater tanks.
Cardamine pratensis, Lady's Smock. 1 J. Meadow-like part of irrigation area, l.
C. flexuosa, Wavy Bitter Cress. 4 CG-I. C, G, H, by streams r; I rough ground.
Barbarea vulgaris, Common Winter Cress. 2 DK. K, by stream; D, waste.
Rorippa islandica, Marsh Yellow Cress. 7 BCF-HLM. Irrigation areas, o; by streams, sludge piles and rough ground.
Erysimum cheiranthoides, Treacle-mustard. 4 A-D. Waste places, sludge drying beds, sludge piles and allotments.
Alliaria petiolata, Jack-by-the-Hedge. 10 AC-EH-M. Edges of irrigation areas, by streams, wooded strips, rough ground, etc.; o.
Sisymbrium officinale, Hedge-mustard. 3 B-D. Waste places, sludge drying beds, rough ground; o.
S. altissimum. 2 BE. B, sludge pile; E, track.
Silene alba, Evening Campion. 1 C. Rough ground
Cerastium holosteoides, Wayside Mouse-ear Chickweed. 2 KM. Rough ground.
Stellaria media, Chickweed. 9 A-FIKM. Sludge drying beds, sludge piles, la; allotments a; edges irrigation areas, waste and bare places, f.
S. holostea, Greater Stitchwort. 1K. Edge stream, r.
Chenopodium polyspermum, Many-seeded Goose-foot. 3 ABD. D, stormwater tanks, la; B, sludge drying bed; A, waste place.
C. album, White Goose-foot. 8 A-GM. Sludge drying beds and sludge piles, a-d; edges irrigation areas lf; rough places, etc., o.
C. ficifolium, Fig-leaved Goose-foot. 5 A-E. Sludge piles and sludge drying beds a; waste places l.
C. rubrum, Red Goose-foot. 1 L. Irrigation area.
Atriplex hastata, Halberd-leaved Orache. 6 A-DGI. Sludge drying beds and sludge piles la; edges irrigation areas, rough places, etc., l.
Malva sylvestris, Common Mallow. 5 A-E. Edges sludge drying beds, tracks, rough places; l.
Lavatera trimestris L. 1 A. Site of stream now put underground.
Geranium molle, Dove's-foot Crane's-bill. 3 CDG. Edge of irrigation area, lawn, stormwater tank and rough ground.
Acer pseudoplatanus, Sycamore. 3 IKL. L, wooded strip of north-end, f; I, K, r.
A. campestre, Hedge-Maple. 3 IKL. Bushes on banks of streams.
Medicago lupulina, Black Medick. 2 LM. Tracks.
Melilotus alba, White Melilot. 1 C. Rough ground.
Trifolium pratense, Red Clover. 3 K-M. Rough ground and track.
T. hybridum, Alsike Clover. 1 A. Site of stream now put underground.
Trepens, White Clover. 8 CDF-HJKM. Track, o; C, rough ground, la; F, edge irrigation area.
Vicia pannonica Crantz var *purpurascens* (D.C.) Boiss. 1 C. Covered-in trench of faeces. Determined at British Museum (Natural History).
V. cracca, Tufted Vetch. 1 C. Rough ground.
V. angustifolia, Narrow-leaved Vetch. 1 E. Rough ground.
Phaseolus multiflorus, Scarlet Runner Bean. 1 A. Site of stream now put underground.

- Filipendula ulmaria*, Meadow-sweet. 2 HK. H, by stream, lf; K, edge irrigation area.
- Rubus idaeus*, Raspberry. 2 CE. E, wooded strip; C, edge irrigation area.
- R. fruticosus* s.l., Bramble. 7 ACEIK-M. Wooded strips and hedgerows, o; several places rough ground.
- Potentilla reptans*, Creeping Cinquefoil. 10 B-EG-IK-M. Rough places and tracks, o; storm-water tank at one time rapidly covering tank with dozens of long runners per plant.
- Crataegus monogyna*, Common Hawthorn. 3 EIK. I, the hedge is composed of this; E, wooded strip; K, bush by stream.
- Sorbus aucuparia*, Mountain Ash. 1 E. Rough ground, small tree.
- Malus sylvestris*, Apple. 1 E. Tree.
- Ribes nigrum*, Black Currant. 1 E. Bushes in neglected allotment.
- Epilobium hirsutum*, Codlins and Cream. 12 A-EG-M. Most irrigation areas chiefly by edges and by streams, lf; storm overflow, a; elsewhere in rough ground, etc., o.
- E. cf. obscurum*, Dull-leaved Willowherb. 1 M. Edge irrigation area.
- Chamaenerion angustifolium*, Rose-bay. 3 BDG. B, sludge pile, l; D and G, rough ground.
- Hedera helix*, Ivy. 4 EIKL. K, f in wooded strip where mostly confined to ground; I and K by streams.
- Anthriscus sylvestris*, Wild Beaked Parsley. 13 Wooded strips and by streams, a; rough ground and edges irrigation areas, la.
- Heracleum sphondylium*, Hog-weed. 13. Rough ground and wooded strips, f; elsewhere occasional but widespread although rare in irrigation areas.
- Cucurbita pepo* L., Marrow. 1 B. Sludge drying bed.
- Bryonia dioica*, White Bryony. 2 BI. B, rough ground; I, wooded strip.
- Euphorbia helioscopia*, Sun spurge. 1 B. Rough ground.
- E. peplus*, Petty Spurge. 2 DE. D, allotment; E, rough ground.
- Polygonum aviculare* s.l., Common Knot-grass. 10 A-HJL. Sludge piles, a; sludge drying beds, most tracks and edges irrigation areas, o; D, rough ground used as yard, va.
- P. amphibium*, Amphibious Persicaria. 1 D. Small irrigation area, la; adjacent rough ground.
- P. persicaria*, Common Persicaria. 12 A-HJ-M. Irrigation areas f-a; sludge drying beds, sludge piles, wastes, stormwater tanks and allotments, o; storm overflow, a.
- P. lapathifolium*, Pale-flowered Persicaria. 7 A-FI. Sludge piles, stormwater tanks, irrigation areas (chiefly edges), allotments and wastes, l; much more often in dry habitat than *P. persicaria*.
- P. convolvulus*, Black Bindweed. 2 DI. D, stormwater tank; I, wooded strip.
- P. cuspidatum*. 1 E. Rough ground.
- Rumex acetosella* s.l., Sheep's Sorrel. 1 E. Rough ground.
- R. acetosa*, Common Sorrel. 4 CEKL. Rough ground, l.
- R. crispus*, Curled Dock. 2 GI. Rough ground.
- R. obtusifolius*, Broad-leaved Dock. 13. All irrigation areas, a; rough ground, sludge piles and sludge drying beds, f; allotments and wooded strips.
- Urtica urens*, Small Nettle. 6 A-F. Sludge piles and sludge drying beds, a; rough ground and allotments, la; all in A-E. F, irrigation area.
- U. dioica*, Great Nettle. 13. Edges of all irrigation areas va, and la in central parts; rough ground, storm overflow, streamsides, edges of sludge drying beds and wooded strips, a; sludge piles, lf.
- Humulus lupulus*, Hop. 1 E. On fence.
- Ulmus glabra*, Wych Elm. 2 KL. Wooded strips, f in K.
- U. procera*, Common Elm. 7 CDGI-L. Wooded strip in K, o; elsewhere o isolated trees and bushes.
- Platanus* sp., Plane. 2 KL. Wooded strips.
- Quercus robur*, Common Oak. 3 EKL. Isolated tree and sapling in K, seedling in E.
- Populus cf. nigra*, Black Poplar. 5 AEIKL. K, L and A, wooded strips, f; elsewhere isolated trees.
- P. nigra* var. *italica* Du Roi., Lombardy Poplar. 3 AEF. Few trees on boundary ridge E-F; wooded strip, A.
- Salix alba*, White Willow. 1 E. Tree(s).
- S. fragilis*, Crack Willow. 4 CEKM. E, several trees; M, sapling; C, sludge drying bed, apparently from seed.
- S. viminalis*, Common Osier. 1 C. Sludge drying bed, apparently from seed.
- S. cinerea*, Common Sallow. 1 C. Ditto.
- Convolvulus arvensis*, Field Bindweed. 6 C-EHIM. Chiefly rough ground, l; edges irrigation areas and by track.
- Calystegia sepium*, Great Bindweed. 4 HK-M. Edges irrigation areas and by stream; vl and probably always on *Urtica dioica*.
- C. silvatica*, Bladder Bindweed. 4 B-E. By fence, in bushes, etc., l.
- Hyoscyamus niger*, Henbane. 1 B. Rough ground near sludge drying beds.
- Solanum dulcamara*, Bittersweet. 4 A-CI. A and B, rough ground; C, sludge pile; I, hedgerow.
- S. nigrum*, Black Nightshade. 6 A-F. A and E, f along site of stream put underground; B, C and D, sludge drying beds; F, irrigation area when dry, lf; rough ground, sludge piles and allotment.
- Lycopersicon esculentum*, Mill Tomato. 5 B-F. Sludge drying beds, va; sludge piles and storm-water tanks, a; rough ground and one irrigation area.
- Datura stramonium*, Thorn Apple. 1 A. Several plants on site of stream put underground.
- Verbascum thapsus*, Great Mullein. 1 D. Waste.
- Linaria vulgaris*, Yellow Toad-flax. 1 E. Rough ground, lf.
- Scrophularia aquatica*, Water Figwort. 1 K. By stream.
- Veronica chamaedrys*, Germander Speedwell. 1 K. Stream-bank.
- V. persica*, Tournefort's Speedwell. 4 AEKM. Rough ground, wastes and allotments, r.
- V. polita*, Grey Field Speedwell. 1 E. Allotment, lf.

- Ballota nigra*, Black Horehound. 4 ADKL. K and L, wooded strips; A, rough ground; D, track.
- Lamium purpureum*, Red Dead-nettle. 8 B-FHJM. Edges irrigation areas and in sludge drying beds, o; waste, by track and allotment.
- L. album*, White Dead-nettle. 13. Rough ground, vf; edges irrigation areas, f; o elsewhere including tracks, sludge pile, stormwater tanks, allotments, wastes and wooded strips.
- Galeopsis tetrahit* s.l., Common Hemp-nettle. 1 C. Sludge drying bed, very luxuriant.
- Glechoma hederacea*, Ground Ivy. 7 CEFHK-M. Rough ground, lf; waste, allotment, track, wooded strip and stream-bank.
- Plantago major*, Greater Plantain. 9 A-FK-M. Tracks, f; rough ground, edge irrigation area, sludge drying beds, waste and allotment.
- P. lanceolata*, Ribwort Plantain. 6 C-EK-M. Chiefly tracks, l; rough ground, lawn, waste, and edge irrigation area.
- Galium aparine*, Goose-Grass. 11 A-HJLM. Edges irrigation areas, sludge drying beds and rough ground, l; stream-banks, waste, sludge pile, stormwater tanks and wooded strip. Usually climbing on *Urtica dioica*.
- Sambucus nigra*, Common Elder. 9 AC-EG-IKL. Wooded strips, lf; rough ground, edges irrigation areas and banks of streams, o bushes.
- Helianthus annuus*, Sun-flower. 1 C. Plants in and at edges of sludge drying beds.
- Bidens tripartita*, Trifid Bur-Marigold. 1 L. Storm overflow, a.
- Galinsoga parviflora*, Kew-weed. 3 C-E. D, allotment, almost d and spreading to sludge pile; E, allotment; C, sludge drying beds.
- Senecio erucifolius*, Hoary Ragwort. 2 EK. E, rough ground; K, trackside.
- S. squalidus*, Oxford Ragwort. 4 A-D. Waste places, sludge piles, sludge drying beds and rough ground.
- S. viscosus*, Viscid Groundsel. 3 BDE. B and E, tracks; D, rough ground.
- S. vulgaris*, Common Groundsel. 10 A-FIK-M. Sludge drying beds, sludge piles and allotments, a; rough ground, wastes, etc., o.
- Tussilago farfara*, Colt's-foot. 4 DEKM. Rough ground, vl; track and stream bank.
- Calendula officinalis*, Pot Marigold. 1 D. Stormwater tank, one plant.
- Solidago* cf. *canadensis*, Garden Golden Rod. 3 CKM. Rough ground and edge sludge drying bed.
- Aster* sp., Michaelmas Daisy. 3 AKM. Rough ground, vl.
- Achillea millefolium*, Yarrow. 6 BCEILM. Rough ground, vl; edges irrigation areas and track.
- Tripleurospermum maritimum*, Scentless Mayweed. 7 A-EHM. Local; chiefly tracks; waste places, rough ground, sludge pile and stormwater tank.
- Matricaria recutita*, Wild Chamomile. 4 A-D. B, sludge pile, d; D, waste place, a; o around irrigation area in A and sludge drying bed in C.
- M. matricarioides*, Rayless Mayweed. 5 B-EL. Sludge piles, o; l elsewhere—tracks, waste places, rough ground and sludge drying beds.
- Chrysanthemum leucanthemum*, Ox-eye Daisy. 2 EM. Rough places.
- Artemisia vulgaris*, Mugwort. 10 A-FHIKL. Rough places, wastes and tracks, l; edges irrigation areas, allotment and stream bank.
- Arctium* sp. Burdock. 7 B-EGKL. Rough ground, o; wastes, sludge pile and stream bank.
- Carduus acanthoides*, Watted Thistle. 1 C. Thriving colonies by old railway track spreading to edge sludge drying beds and sludge pile.
- Cirsium vulgare*, Spear Plume-Thistle. 10 BCE-HJ-M. Edges irrigation areas, o; storm overflow, f; rough ground, waste, sludge pile, track, stream bank and wooded strip.
- C. arvense*, Creeping Plume-Thistle. 13. Edges irrigation areas, o; sludge piles, rough ground, allotment and wooded strip.
- Centaurea nigra* s.l., Black Knapweed. 2 DL. D, rough ground; L, track.
- Lapsana communis*, Nipplewort. 3 ADM. A, wooded strip; D, sludge pile; M, rough ground.
- Hypochoeris radicata*, Long-rooted Cat's ear. 4 BDEL. Rough ground, l; track.
- Leontodon autumnalis*, Autumn Hawk-bit. 3 DEM. Tracks and rough ground, r.
- Picris echioides*, Bristly Ox-tongue. 1 M. Rough ground.
- Tragopogon pratensis*, Goat's-beard. 2 CK. C, rough ground; K, track.
- Lactuca serriola*, Prickly Lettuce. 7 B-EHKM. Edges sludge drying beds and sludge piles, o; stream banks, edge irrigation area and rough ground (lf M). Entire-leaved form most frequent but cut-leaved seen C.
- Sonchus arvensis*, Corn Sow-thistle. 1 B. Sludge pile.
- S. oleraceus*, Common Sow-thistle. 7 A-FM. Sludge drying beds and sludge piles, o; irrigation areas, rough ground and waste places.
- S. asper*, Rough Sow-thistle. 2 BF. B, sludge drying bed; F, irrigation area.
- Crepis vesicaria*, Beaked Hawk's-beard. 1 C. Rough ground.
- C. capillaris*, Smooth Hawk's-beard. 1 B. Rough ground.
- Taraxacum* sp., Dandelion. 13. Rough ground and tracks, f., edges irrigation areas, sludge drying beds, lawns, etc., o.
- Endymion non-scriptus*, Bluebell. 1 K. One plant in rough ground near trees.
- Juncus bufonius*, Toad Rush. 1 B. Sludge pile.
- J. effusus*, Soft Rush. 2 HJ. Single plants in irrigation areas.
- Iris pseudacorus*, Yellow Iris. 2 JL. Storm overflow, large clump; J, irrigation area, single plant.
- I. cf. germanica*, Garden Iris. 1 A. Edge irrigation area.
- Arum maculatum*, Cuckoo-pint. 1 L. Wooded strip, lf.
- Glyceria fluitans* s.l. Flote-grass. 2 HK. Irrigation areas, la.
- Festuca rubra*, Creeping Fescue. 1 K. Rough ground, lf.
- Lolium perenne*, Common Rye-grass. 7 B-EK-M. D, irrigation area, la; rough ground lf; tracks.

- L. multiflorum*, Italian Rye-grass. 13. A, H (north half), J, K, L and M, irrigation areas, cd with *Poa trivialis*, and with *Agropyron repens* in D. Irrigation area F and edges G, d. Rough ground, lf; stormwater tanks 1960, ld; spasmodic elsewhere.
- Poa annua*, Annual Meadow Grass. 12 A-EG-M. Tracks, lawn D, a; sludge drying beds C, d at one time; rough ground, wooded strips and allotments, lf.
- P. pratensis* s.l., Smooth Meadow-grass. 6 ECEGKL. Rough ground, lf; edge irrigation area and track.
- P. trivialis*, Rough Meadow-grass. 12 A-EG-M. A, H (north half), J, K, L and M, irrigation areas, cd with *Lolium multiflorum*. Irrigation areas G (with *Lolium multiflorum* round edges) and I, d. Sludge-piles la, sludge drying beds lf. In all above habitats it was very luxuriant and broad-leaved. Rough ground (o), lawn, tracks and stream bank.
- Dactylis glomerata*, Cock's-foot Grass. 9 ACDG-IK-M. Rough ground lf; irrigation areas and edges, and wooded strips, l.
- Bromus ramosus*, Rough Brome. 1 L. Wooded strip.
- B. sterilis*, Barren Brome. 8 B-DI-M. Rough ground, edges irrigation areas, sludge piles, wastes and tracks, o.
- B. mollis* s.l., Soft Brome. 6 BDGIKL. Rough ground and tracks, lf; waste.
- Agropyron repens*, Couch Grass. 11 A-FHJ-M. Edges irrigation areas, edges sludge drying beds, rough ground, sludge piles and wastes, lf; irrigation area in D, cd with *Lolium multiflorum*.
- Triticum* sp., Wheat. 1 C. Sludge pile.
- Hordeum murinum*, Wall Barley. 7 ACEGHLM. Tracks, l; rough ground, sludge pile and by garden.
- Arrhenatherum elatius*, False Oat. 10 A-DG-IK-M. Edges irrigation areas, wooded strips and rough ground, la; stream bank (a at one point), sludge pile and stormwater tank.
- Holcus lanatus*, Yorkshire Fog. 7 CFGI-KM. Wooded strips, lf; edges irrigation areas and rough ground, r.
- Alopecurus pratensis*, Meadow Foxtail. 9 E-M. Rough ground, meadow-like part irrigation area J, lf; edges irrigation areas, lawn.
- Phalaris arundinacea*, Reed-grass. 1 H. South half of irrigation area, d; ousting most other plants—a truly magnificent stand. A few plants in north half of irrigation area.
- P. canariensis*, Canary Grass. 2 CD. D, on covered-in trench, a; D, sludge drying bed.

REFERENCES

- CLAPHAM, A. R., TUTIN T. G., and WARBURG, E. F., 1952, *Flora of the British Isles*.
- DANDY, J. E., 1958, *List of British Vascular Plants*, London.
- JOHNS, Rev. C. A., 1905, *Flowers of the Field* (an edition rewritten and revised by G. S. Boulger).
- JONES, A. W., 1960, The Aquatic and Wasteland Plants of Bookham Common. *Lond. Nat.*, 39, 76-89.
- RIDEAL, SAMUEL, 1900, *Sewage and the Bacterial Purification of Sewage*.

The London Thames and the Changing Levels of the Land and the Sea

By G. M. WOODLEY

“UP betimes . . . at Whitehall I find that there was last night the greatest tide that ever was remembered in England to have been in this river.” Thus on 7 December, 1663, Mr. Pepys records an incident in the long history of flooding by the River Thames in the London area—a history which includes several inundations in the period 1235 to 1242 and which records numerous instances after that of 1663. Amongst those which occurred in the 18th century was that of 1791 when “ . . . boats came through the passage of Old Palace Yard . . . up to Westminster Hall Gate . . . Westminster Hall suffered much, the water ran in at the great door for upwards of an hour”. It was as a consequence of this flooding of Westminster Hall (the third occasion within thirty years) that the floor of the Hall was raised by several feet.

Many exceptionally high tides occurred in the 19th century and it was those which occurred between 1874 and 1877 which brought into being the statutes that, for the first time, provided London with a comprehensive system of flood defences. These served London well until 1928 when a tide higher than any previously recorded overtopped parts of the defences, and resulted in the prescription of higher flood prevention levels.

Further exceptionally high tides occurred in 1938, 1949 and 1953, and although none caused serious flooding in London, the extraordinary height of the 1953 tide has led to the Government's present consideration of a proposal that a movable flood prevention barrier be provided on the Thames below London.

The causes of exceptionally high tides in the Thames and other matters relating to the problem have been the subject of comprehensive investigations by the responsible authorities over a prolonged period of years. It is not possible within the space available to quote sources or to list the many bodies and persons whose work was the basis of these investigations, and only the barest summary of the results of their work will be given here. These results are of peculiar interest to those archaeologists whose work is concerned with the riverside districts of London from Roman times to the end of the mediaeval period, since little is known with certainty of changes which have taken place in the lines of the banks of the Thames, or of the relationship between occupation levels and high water level of the present day.

In brief, the investigations show that the embanking of the Thames in the London area has been necessarily a continuous process over many centuries because of:

- (a) A slow change in the relative levels of land and sea, due in part to subsidence of S.E. England; and in part to the increasing in height of sea level as a consequence of the melting of the Northern ice cap.¹ The present rate of change of the relative levels of the land and the sea in the area of the Thames estuary is about 12 inches per 100 years.
- (b) Increases in the tidal range of the river as a consequence of (a) and of the narrowing of the channel caused by the encroachment of wharves and banks into the river.
- (c) The progressive increase of the height of occasional exceptionally high tides as a result of (a) and (b). Previous highest recorded levels of

such tides have been exceeded progressively in 1841, 1874, 1875, 1881, 1928 and 1953.

In addition it has been shown that exceptionally high tides in the Thames are caused by the effects of certain meteorological disturbances in the neighbourhood of the northern part of the North sea, and that the frequency of these disturbances seems to be increasing.

With regard to the changes of relative levels, confirmatory evidence provided by archaeologists suggests that the overall change of level since Roman times is of the order of 15 feet, e.g., remains of Romano-British huts have been observed on the foreshore of the Thames at Tilbury some 13 feet below Trinity High Water level; similar remains have been reported at Brentford. In excavations at Crossness, Roman pottery is said to have been found on a layer of peat about 16 feet below high water level.

It is on record that borings have disclosed in the buried channel of the Thames that "what was the surface of the land in the Neolithic Age is now some 60 to 70 feet below mean sea level". This statement seems to indicate that the changes of level under consideration may be a continuance of the process which separated Great Britain from the continent, and the Thames from the Rhine.

The rate of change is not likely to have been uniform; indeed it has been said that evidence seems to indicate that there have been occasional periods of a rapid rise of sea level.

My own observations, made over a period of 30 years, in connection with excavations in coffer dams or behind existing river walls confirm conclusively that the relative levels of the land and the river have changed considerably over the centuries and that the change has been a progressive process. It is a fortunate fact in the present connection that timber was used almost exclusively for the construction of wharves and jetties from Roman times to the 19th century. Timber in a constantly wet condition is preserved indefinitely; consequently such old structures, some of them quite certainly of Roman date, are often met with in excavations and where the remains are sufficient to give an indication of probable deck level, it is usually evident that it would be submerged, or more often so than not, under present tidal conditions.

For a proper understanding of the complexity of the problems involved in attempting to assess the probable relationship between occupation levels of the present day and those of various periods back to the Roman, it is necessary to consider, at some length, existing tidal conditions in the London Thames; and thereafter to attempt an assessment of conditions at, say, 55 B.C.

It is stressed that the following statements regarding tidal matters are in very general terms indeed.

Tidal phenomena are, of course, due fundamentally to tractive forces set up by the attraction of the moon and the sun. Since the relative positions of these bodies and the earth are constantly changing within certain regular cycles, it follows that the effective magnitude of the tractive force will vary accordingly. The only cycle of which we need take account in the present consideration is that during which the moon completes one revolution around the earth. The maximum effects are at new moon and full moon and the minimum effects occur at the quarters. (There is, in fact, a lag of about $2\frac{1}{2}$ days between cause and its effects in the Thames, mainly due to a phenomenon known as the Age of the Tide,

but partly due to the fact that tides experienced in the North Sea and the Thames estuary are generated in the Atlantic).

A lunar month may be roughly divided into four tidal periods; tides which occur during the new and full moon periods are "spring" tides and those which occur during the quarter periods are "neap" tides.

Tides in the Thames flow about every 12 hours, consequently high waters and low waters both occur twice daily. The difference in elevation between consecutive high and low waters is called the "range" of the tides. The range of spring tides is greater than is the range of neap tides, and at London Bridge the range of neaps varies from about 11 feet to about 17 feet, and springs from about 17 feet to about 24 feet. The range of all tides varies progressively between the minima and maxima indicated.

In a tidal river the range is governed by various factors, prime amongst which are the relationship between the width of the mouth of the estuary and the width of the river; and the gradient of the bed. Narrowing of the effective width of the river and deepening of the channel will cause increases in the range of tides.

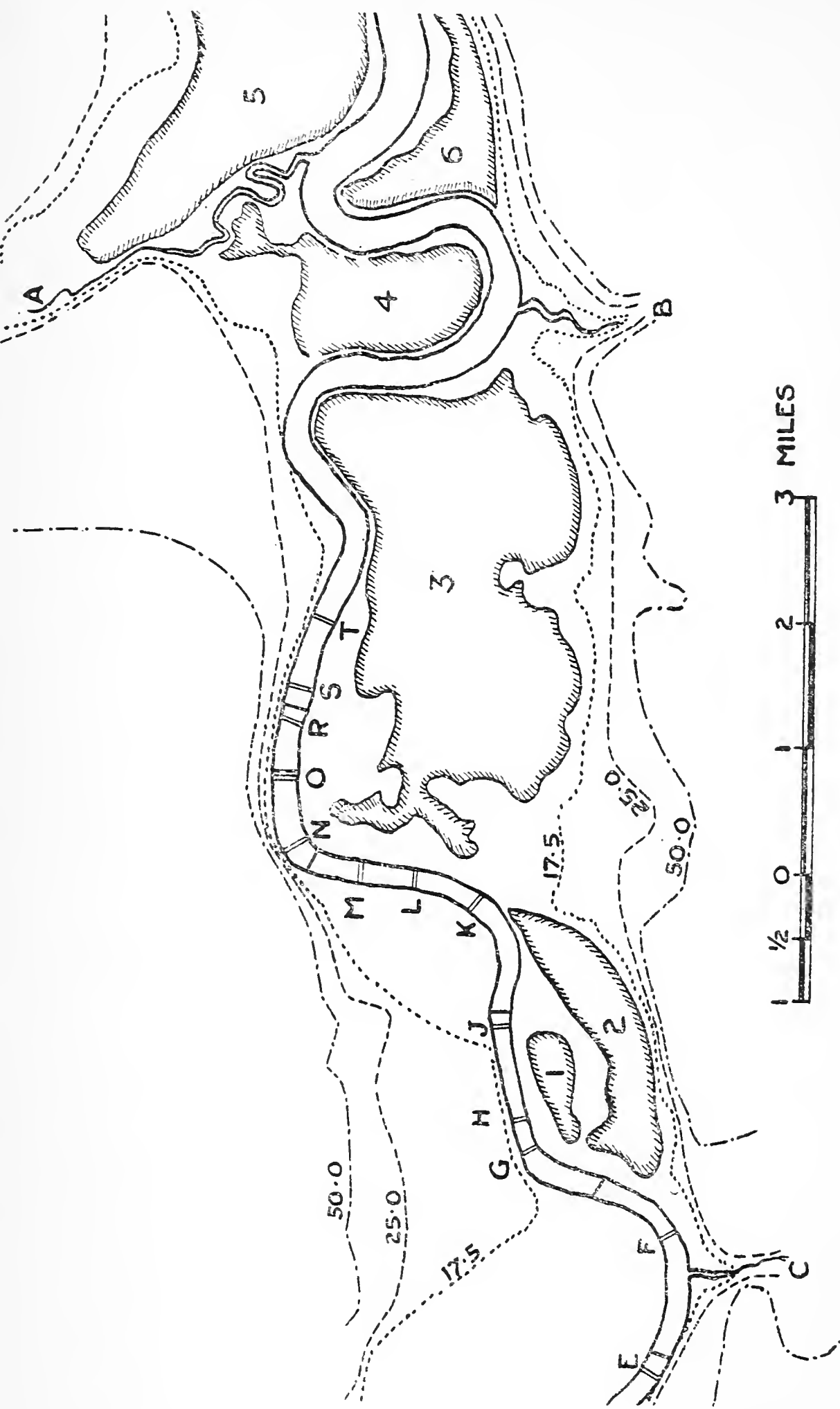
In general high water levels become higher and low water levels lower as a tide passes up a river, and this process continues so far as the gradient of the bed and certain other conditions permit it to happen.

The range of all tides is greater at London Bridge than at Southend and high waters at London Bridge are of the order of three feet higher than are high water levels at Southend. Levels attained by tides at any place are dependant on many other factors besides the fundamentals described, e.g. the configuration of coast lines and meteorological conditions. Heights given in tide tables are predictions of levels which will be attained, provided that meteorological conditions prove to be those which are usually experienced at the place to which the predictions relate, at the time of the year when the tides occur. All tides however are subject to unpredictable variations due to adverse meteorological conditions and variations of around predicted level ± 12 ins. are common, particularly during the winter months.

The term "exceptionally high tide", used so frequently here, is not easily defined; but in the present connection is used to denote a spring tide which, at high water, exceeds predicted level by the order of three feet, or more.

The meteorological disturbances which cause exceptionally high tides are, in general, deep depressions which cause strong N.W. winds in the northern part of the North Sea. These winds result in a raising of sea level towards the East Coast, and the effect of this raising, called a surge, is propagated southwards to the Thames estuary, etc. The effects of such a surge may be substantial, as in 1953, when sea level was raised at Southend by about eight feet. Surges of varying altitude are experienced fairly frequently and usually pass without untoward effect because they tend to occur, generally, at or about, times of low water. Dangerous conditions only arise when the peak of a surge arrives, as in 1953, within an hour or so of high water of a spring tide.

The natural flow of the Thames from its catchment area through London does not, at the present time, constitute a serious risk of flooding. The effects of the heaviest recorded upland flow, in conjunction with high water of a maximum normal spring tide could be measured, at London Bridge, in inches rather than in feet. The coincidence of heavy upland flow with an exceptionally high tide could however give rise to some risk.



SKETCH MAP

All levels are related to *Ordnance Datum (Newlyn)*.
Approximate contours at 50 ft.; 25 ft. and 17.5 ft. (the latter height corresponds to the average levels of the walls and banks of the river).
Areas numbered 1 to 6 are generally below average high water level in the river, which is about 11.00 ft.

KEY

- | | | | |
|---------------|---------------------|----------------|--------------|
| A—The Lee. | B—The Ravensbourne. | C—The Wandle. | |
| E—Putney. | J—Chelsea. | N—Waterloo. | R—Southwark. |
| F—Wandsworth. | K—Vauxhall. | O—Blackfriars. | S—London. |
| | | | T—Tower. |
- Tributary Rivers*
- Bridges*
- L—Lambeth.
M—Westminster.

That then, is a general picture of present and recent tidal conditions in the Thames in the London area.

The probable nature of the Thames in 55 B.C. is a matter for conjecture, and a good deal has been written on the subject by people more competent to do so than I; it is therefore with diffidence and with due regard to the investigations mentioned above that I offer suggestions as to what the main conditions may have been.

That which, for want of a better name, I would call the Paleolithic Thames was, of course, a river of vaster dimensions than is the Thames of to-day. I think some idea of its probable size is indicated by the contour sketch map, but a better idea of scale is perhaps provided by the view, looking north towards the Thames from the Southern Railway between Wimbledon and Earlsfield stations.

The view, at an angle of about 30° to the left of the direction of travel towards Earlsfield, is along a plain about $\frac{1}{4}$ mile wide, which seems to lie in the probable bed of the Wandle's ancient predecessor. In this plain, with a width of 20 feet and a depth of 18 ins. or thereabouts, flows the modern Wandle.

The Paleolithic Thames had little relationship to the Thames of 55 B.C. Indeed it seems likely that, discounting the probably considerable areas of marshes and saltings in its flood plain, the Thames of that time was much shallower and of a narrower channel than is the Thames of to-day.

The tidal limit of the river, at present provided artificially by Teddington Weir some 18 miles above London Bridge, was probably not much above the site of London Bridge in 55 B.C. Consequently there would be little or no tidal variation, except on the infrequent occasions of the occurrence of exceptionally high tides.

From study of maps on which the contour sketch map is based it appears to be probable that the Thames now flows through an old flood plain lying in part of the buried bed of its Paleolithic ancestor. The wide expanse of this plain east of the Vauxhall-Waterloo reach includes the low lying area numbered 3 on the sketch map; roughly in the middle of this area is the lowest lying land in central London. It seems very possible that in Roman times the marshes here were largely land-locked and were connected to the river, probably at the N.E. of area 3, by natural drainage channels through which high tides would occasionally flood the marshes. It may be that the area contained sizeable lakes.

The embanking of the Thames from Deptford to Vauxhall has been attributed to the Romans; there is no doubt that such embanking was done, but I think it likely that it was done piecemeal, and much of it in the mediaeval period. I suggest that the Romans did some embanking here and there, but that it was done relatively late in their stay to protect lands which they had occupied and was not done in order to gain land from the river. May it not have been inspired in part by an increase in high water levels, or by some experience of exceptionally high tides? It is true that these exceptionally high tides are infrequent to-day, and having regard to the suggested present increase in the frequency of the appropriate meteorological conditions, it may be that they were even less frequent then, but even one such tide might have been sufficient to have made the Romans attempt to provide a reasonable degree of protection against flooding.

Between Lambeth and Westminster bridges, a reach which I suggest was free of tidal influence in 55 B.C., the width of the Thames at the

present time varies from about 650 feet at low water spring tide, to the full bank width of about 800 feet at high water, and the maximum depth varies, very roughly, from less than ten feet to more than 30 feet.²

On the basis of average conditions over the past 70 years, with annual rainfall of 29 inches, and assuming a free flowing river, it is probable that the present natural flow, disregarding dry weather conditions of the summer months and considering only average winter flow (some four to five times greater than dry weather flow) could probably be contained in a channel some 200 feet in width with an average depth of water of about four feet. Since occasional flows of up to about twice this volume are experienced in most winters, the channel of such a river would be deeper than the depth of water suggested above. Greater flows such as occur on three or four occasions every decade would, of course, overflow on to a natural flood plain situated generally between the 17.5 contours on the sketch map. On the other hand during dry weather flows the average depth in the river would probably be not more than two feet or thereabouts.

If rainfall conditions at 55 B.C. can be estimated the foregoing may be of some use as a guide to probabilities.

At some period, not far removed from 55 B.C., it seems to me that conditions in the river in the central London area were probably somewhat as I have suggested. Thereafter these would have followed that course of change which has continued to the present day, with all those complexities which present so many difficulties in the assessing of conditions at any intermediate period.

The figure given for the rate of change, i.e. about 12 inches per 100 years, may perhaps be used as a guide but it cannot be used as a yardstick. Apart from it being unlikely that geological or climatic changes proceed at a uniform rate, account has also to be taken of other factors, e.g., tidal cycles additional to that considered; local land subsidences which may or may not occur from place to place,³ and will in any event vary in extent; the possibility of forward and downward movements of lands adjacent to the river owing to foreshore erosion and other causes; the effects, during many centuries, upon the regime of the river of old London Bridge and the changes which must have followed its demolition; and the effects of narrowing of the channel⁴ and dredging.

1. Geological evidence established, a long time ago, that submergence of land in the S.E. of England and emergence of land in Scotland had occurred in the geologically recent past. Archaeological and other evidence, supported by the results of Ordnance Survey levelling, indicate that the movement is still in progress. It appears to be generally accepted now that this tilting movement is due to the slow recovery of northern areas from the effects of the great load of ice which covered lands in the Quaternary period, with the consequent subsidence of southern regions.

The recently published report of an 11 year study by a group of Columbia University scientists includes a statement that from studies of undisturbed Atlantic sediment and the use of Carbon 14 determination, there was found reason to believe that the last Ice Age, which began 60,000 years ago, ended not, as was previously thought, 20,000 years ago, but only 11,000 years ago.

2. It may be recalled that a recent attempt to wade across the Thames at Westminster almost succeeded. At minimum low water of maximum spring tides the depth of water in the navigation channel immediately up-stream of Westminster Bridge is not much more than four feet. There are, however, many "pot-holes" near to the piers of the bridge due to turbulence of flow past them. Above the bridge, however, the depth in the navigation channel varies from six feet to 11 feet; the latter depth occurs about opposite to the Victoria Tower.

3. The Ordnance Survey levelling from Newlyn (1911-1925) indicated that relative to the levelling from Liverpool (1840-1860) there had been subsidence in the S.E. of England, with a maximum of the order of 1.25 ft., together with local subsidences, of relatively substantial amounts in central London areas. Differences of values, Newlyn-Liverpool, vary in general from bench mark to bench mark: average bench mark differences were of the following order: Southend 1.50; Tilbury 1.15; Woolwich 1.00; Westminster 1.25; Chiswick 1.33; Old Windsor 1.00, and near to Wallingford 0.75. (The difference Newlyn-Liverpool was 0.40.)

4. I think it is likely that between Roman times and the present day the Thames in the London area, below Westminster, attained its greatest width during the mediaeval period; from that time onwards encroachment of banks into the river has been a progressive process. This encroachment was not necessarily done in order to gain land but was often done for constructional reasons, e.g., it was sometimes simpler to construct a new timber wall in front of another rather than to repair the latter. I have seen instances where as many as four or five such walls have been constructed within a space of five to ten feet. No doubt owners of premises adjacent to such as these found it necessary to come into line, just as others probably found it convenient for wharfrage reasons, to straighten the line and construct walls where previously earth banks had followed devious lines around inlets or bays.

Some Notes on the Geology of Sutton and District

By R. F. MOORMAN, F.G.S.

INTRODUCTION

THE town of Sutton, part of the Borough of Sutton and Cheam, is approximately twelve miles south of London on the Reigate and Brighton road.

It is situated on the edge of the large synclinal London basin. The beds of chalk along the line of the North Downs dip steeply under London and the surrounding counties to reappear to the north of the capital.

The basin itself consists of Tertiary beds overlain by Quaternary deposits.

The large amount of building between World Wars I and II has made examination of the strata practically impossible except in occasional temporary exposures.

Having lived in the district for a good number of years I have from time to time had the opportunity to examine some of the biggest of these temporary exposures and make records which so far have not been published, and from which the present paper is largely compiled.

THE CHALK

The south side of Sutton is on the dip slope of the Upper Chalk ridge running from Banstead to Epsom Downs. The chalk dips towards the north fairly rapidly between Banstead and Belmont, flattens out for the next mile to Sutton Station where the dip suddenly increases and reaches its maximum along the line of the main road from Cheam through Sutton to Carshalton. All roads to the north of this line run very steeply down-hill and the whole of the chalk soon disappears under the more recent Lower Tertiaries, which have been deposited in this area.

In the Carshalton road are two very large disused chalk pits. One is used by the Sutton District Water Company for their softening tanks and the resultant chalky sludge is dumped in the other. These pits are recorded as in the zone of *Micraster coranguinum*, but a few feet at the top are probably in the *Urtacrinus* Zone, as the zone fossil was found in the road cutting close to the top of one of these.

About 150 yards further west along the Carshalton road there was in 1932-3 a very large chalk exposure during the construction of the Plaza (now Granada) cinema. This was a big undertaking as the site chosen sloped steeply down-hill from the front in Carshalton Road, to the back in Throwley Road. The preliminary work involved the excavation of

some hundreds of tons of chalk, most of which was utilized in filling in a builder's yard some 18 feet below the level at the Carshalton Road side. Not more than 10 feet of chalk was dug out at any one place, but a number of excavations were made starting at different levels, which summarized showed that a total depth of 25 feet was reached, the last seven feet being exposed in holes which were dug to take the large steel stanchions used to support the roof and balcony.

The complete section would appear to be		Feet
Uintacrinus Zone	Soil	$\frac{1}{2}$
	Chalk with <i>Spondylus spinosus</i> , <i>Inoceramus</i> sp. and <i>Echinocorys scutata</i> (small variety) and with two bands of flint	7
	Chalk with <i>Actinocamax verus</i> , spines of <i>Cidaris</i> sp. and <i>Bourgueticrinus ellipticus</i> . Also many <i>Spondylus</i>	3
	Chalk with <i>Inoceramus</i> sp., <i>Echinocorys scutata</i> (large domed shaped varieties typical of the zone) and <i>Spondylus spinosus</i> ..	$7\frac{1}{2}$
Micraster Coranguinum Zone	Original level of builders' yard	
	The holes for the stanchions showed chalk with <i>Micraster coranguinum</i> , (small variety) <i>S. spinosus</i> and <i>E. scutata</i>	7
		<hr/> 25 ft. <hr/>

The most abundant fossil was *Spondylus spinosus* and a number of examples were obtained, some with bases of spines still attached.

The presence of *Actinocamax verus* places the chalk in the base of the zone of *Uintacrinus* or the top of the zone of *Micraster coranguinum*. The fact that *A. verus* appears at a height of 8 feet above the level at which the first *Micraster* appears seems good evidence for placing the top beds in the upper zone and the bottom 14-15 feet in the *Coranguinum* Zone.

Unfortunately no specimens of *Uintacrinus* were obtained but as previously mentioned a fragment was recorded some years previously from a roadside cutting about 150 yards away at about the level of the upper beds.

In 1934 Shinner's Ltd. started work on the large store which now occupies a commanding site in the High Street and Hill Road.

The large temporary excavation on the dip slope of the chalk was a little further north than the exposure at the Plaza cinema. The hard blocky chalk was similar to the lower beds seen at the cinema. About 15 feet of chalk was excavated and levelled off.

The fossils were not prolific but *Spondylus Echinocorys* (dome-shaped) with the zone fossil, somewhat larger than the ones from the cinema, established the zone as *Micraster coranguinum*.

The railway line from Carshalton to Sutton climbs the escarpment in a deep cutting in the chalk which is recorded as being in the same zone, *Micraster* and *Echinocorys* having been found there.

In 1930 work was started on the Sutton By-Pass road which now runs from Morden through the St. Helier Estate to Rosehill, and then via Cheam to join the Brighton Road on Banstead Downs. When the excavations reached a spot close to Cheam village the chalk was encountered, and continued until the end of the road on Banstead Downs.

Deep trenches were dug to take sewer pipes, and from this material and other chalk nearer the surface a considerable number of fossils from the *Coranguinum* Zone were observed. Additional species to those already mentioned were the lamellibranch *Plagiostoma hoperi* the brachiopods *Gibbithyris semigiobosa* and *Cretirhynchia plicatilis*, the echinoid *Conulus albogalerus*, several tiny teeth of the fish *Anacorax falcatus* and the cast of a fish vertebra. A flint band was encountered in most of the deep trenches.

The construction of the new railway line from Wimbledon to Sutton in 1928 and 1929 was a major engineering effort especially in the last mile and a half. The five miles from Wimbledon to Sutton Common Station was fairly straightforward, as long stretches of the line were laid through open fields. From Sutton Common the line is first in a cutting and then climbs on an embankment crossing two roads on bridges before reaching West Sutton Station.

From this station the line had to be taken into a series of twisting deep cuttings as Sutton was fully built-up at this time. Luckily most of the houses had longish gardens and no demolition was necessary, though a number of residents lost a large part of their garden. Four bridges had to be built under the various roads and the line was finally brought out through a gap between houses in Grove Road to join the main line a short distance on the Cheam side of Sutton Station.

The chalk was cut into between Western Road and Cheam Road. Mechanical excavators cut away many thousands of tons from the deep narrow cuttings and loaded it into trucks, the line being roughly laid as the work proceeded. Permission to enter the cuttings during these excavations was refused owing to the danger of the sides of the cuttings collapsing. Falls of chalk were fairly frequent and to complete the job the sides had to be encased in a thick covering of concrete.

I managed to examine some of the material in the trucks after they had been removed from the danger area. Enough fossil material was seen to identify the zone as *Micraster coranguinum*, the zone fossil of normal size combined with *Conulus albogalerus* being good evidence.

Other temporary exposures were seen at various times, and these and a couple of disused and overgrown pits in the Carshalton area were all probably in the *Coranguinum* Zone, though not all of them yielded positive evidence in the way of fossils.

THE THANET SAND

In the area under review there is a narrow band of Thanet sand which runs from Ewell in an easterly direction through Cheam and Sutton, under the Wandle gravels at Carshalton, and on to Beddington and Waddon. In the late 1920's it could still be seen in three brickyards west of Sutton but these have now either been filled in and built over or are filled with rubbish. The sand is now only exposed in temporary excavations.

In 1926 I confirmed that, as stated on page 19 of the Memoir mentioned below, the Nonsuch Pottery near Ewell Church showed Woolwich and Reading clays overlying 10 feet of Thanet beds of which 7 feet of light grey sand was succeeded by 3 feet of brown sand; the base was not reached.

The same year Devine's brick works, which was off the Malden Road about 150 yards north of Cheam Church, showed 7 feet of grey sand at the base of the pit underneath a thick covering of Reading Beds.

The Sutton By-Pass road now passes less than 100 yards from the site of this brick-yard, and cuts across the sand in a south-westerly direction behind Cheam Church.

During the construction grey sand was exposed in the trenches dug for sewer pipes etc. The sand persisted for about 300 yards until the chalk was reached.

For a number of years before the last World War a good section of the sands could be seen at Perrett's Spring Close Potteries off Gander Green Lane, Cheam. Here some 33 feet of the Reading beds overlie 27 feet of grey Thanet sand, the base not being reached.

About 150 yards east of this pit the Sutton District Water Co's artesian well borings showed that the sand was reached at a depth of 47 feet and was about 23 feet in thickness. The chalk was entered at a depth of 70 feet. The full section of these borings is given below in the account of the underground water of the district.

About 1935 John Perring Ltd. started the construction of a large store on the corner of Sutton High Street and West Street. The excavation for the foundations showed 15 feet of grey sand below just over 4 feet of clay of the Reading Beds. The sand is seldom seen in Carshalton as it lies deep below river gravel and clay.

In the Geol. Survey Memoir (H. Dewey and C. N. Bromehead, 1921. The Geology of South London. Explanation of Sheet 270) there are accounts of two wells which were dug. One at Ansell's Paper Mill passed through 60 feet of gravel and clay without reaching the sand. Another at Carshalton Steam Laundry near Carshalton Station passed through the sand under a very thick covering of gravel and clay. The depth at which the sand was reached is not recorded.

At Beddington there is a long narrow ridge of the sand which runs for about a mile in a southerly direction from the park, passing about 150 yards east of the Church. The main road to Croydon cuts through this ridge. On the north side of the road the sand used to be quarried. When seen about 1930 there were upwards of 50 feet of unstratified white and pale yellow sand. The pit has now been filled in and is mostly overgrown, but a large bank of the sand was still to be seen in January, 1961.

There was also, at the time this quarry was being worked, an adjacent pit on the other side of the main road, which showed 30 feet of grey sand overlying 3 feet of loam containing fossil wood. This pit has now been built over, but the sand can still be seen opposite the Sandyhill Garage in the cutting through which the main road passes.

The Ridge continues to Bandon Hill, where there is a vast spread of the sand. Exposures can often be seen in the nearby cemetery and page 19 of the Memoir records that many trial holes dug in the burial grounds proved the maximum depth of the sand was 40 feet. The top beds of the sand were absent.

There are other ridges of the sand at Brandybottle Hill and at Duppas Hill near Waddon.

WOOLWICH AND READING BEDS

These beds which overlie the Thanet sand are of two facies, both of which occur in the Sutton district. The Reading type occurs at Ewell, Cheam and Sutton and consists mostly of mottled clays.

The Woolwich type is prevalent at Croydon and further east. At Carshalton and Beddington both facies are present. The Woolwich beds consist mostly of loams and contain bands of shells in places.

The Reading facies outcrop in a narrow band which curves between Ewell and Sutton and then runs in a straight line to Carshalton where the beds disappear below the gravels of the Wandle.

At Nonsuch Pottery, Ewell, the working faces of the old disused pit were in 1926 very much overgrown with the exception of one in the south-east corner, where the following section was seen and checked in detail with the account given on page 24 of the Memoir which states as follows:—

		Feet
	Soil	1
Pleistocene	{ Reconstructed mottled and yellow clay with many coarse flints	12
	{ White clay	2
Reading Beds	{ Red, mottled with blue-green clay	12
	{ Grey sandy loam, "Nonsuch fireclay"	1½
	{ Glauconitic loamy sand, "Strong brick clay"	4½
	{ Sand with pebbles	½
	{ Glauconitic sand with purple "shale". Bright red laminated clay. Pebble bed with sharks' teeth and many green coated flints	4½
	{ Hard blue clay	7
Thanet Sand	{ Grey sand	7
	{ Brown sand, base not reached	3

This pit had been worked continuously since the days of Henry VIII.

The grey sandy loam is a rare fireclay from which the noted Nonsuch fire-bricks used to be made.

At Devine's brick pit near Cheam Church a section the same year showed about 26 feet of the Reading beds under a capping of clayey gravel. Six feet of sandy loam, brightly coloured, overlies 3 feet of grey-green clay under which was 7 feet of mottled clay, followed by another 7 feet of green glauconitic sandy loam, with a pebble bed with green-coated flints scattered sparsely through the lower part.

At the base of the pit 7 feet of Thanet sand was exposed.

The colouring in the pit was quite remarkable as the sandy loam was pink, light green, yellow and mauve and the mottled clays were crimson, magenta, yellow, grey and green. This pit has unfortunately been built over.

The Sutton By-Pass road cuts through the Reading beds close to the site of Devine's pit and the brightly coloured sandy loam and part of the mottled clays were seen in the trenches which were dug.

Having collected from the section at Perrett's Spring Close Potteries at Cheam on a number of occasions between 1928 and 1934, I can confirm that the details below were as stated in the Memoir on page 25.

		Feet
London Clay	{ Basement bed of London clay with many shells of <i>Ostrea bellovacina</i> and <i>Ostrea tenera</i>	2—3
	{ Blue clay and sand	8—9
Reading Beds	{ White to grey sand	5
	{ Bright red mottled clay	6
	{ Glauconitic loam with two beds of pebbles and shark's teeth	14
Thanet Sand	{ Grey sand, base not reached	27

The artesian wells in Gander Green Lane pass through 31 feet of sand and mottled clays.

The work on the new railway line showed a deep cutting in the Reading beds just south of West Sutton Station between Norman Road and Gander Green Lane. About 3 feet of red mottled clay overlies 13 feet of green glauconitic loam with pebbles. The bottom 8 feet of the cutting penetrated the grey Thanet sand.

The mottled clays are sometimes seen during temporary road excavations in Sutton and two deep trenches in Manor Lane showed bright crimson and variegated clays a few years before the Second World War.

The two well borings at Carshalton proved a considerable depth of Reading beds with mottled clays, but no exact record was kept.

Near Butter Hill, Carshalton, a bed containing *Ostrea* and *Brotia* has been seen in trenches (Memoir page 25). This shell bed denotes the Woolwich facies, so that in Carshalton we have the two types, the mottled clays resting on the shell bed.

In 1932 a new sewer was laid at a depth of 15 feet along a road on the west side of Beddington Park. The excavation for the pipes passed through about 12 feet of the mottled clays below which was a hard matrix of limestone just over a foot thick, packed with shells and as hard as concrete. The excavation work required the use of a number of pneumatic drills and was a lengthy job as the shell bed persisted along the road for nearly 200 yards. The work had been put out to contract, and a pick and shovel job in soft clays had been estimated for.

An examination of a number of blocks of the material showed many shells, some in a very good state of preservation and many internal casts. Specimens of *Corbicula cuneiformis*, *Corbicula cordata*, *Ostrea* sp. *Brotia melanioides* and *Tympanotonos funatus* were obtained.

LONDON CLAY

The London clay near Sutton lies to the north of the town and as there are now no longer any brickyards working is seldom seen except in temporary exposures.

Starting from the west of our area the Memoir records a pit near Coldharbour Farm between Ewell and Worcester Park. This was worked by the Worcester Park Brick Co. Ltd., for a number of years. It was 50 feet deep and fossils preserved as pyritised casts were fairly common, 12 species of shells being named in the Memoir pages 34-5. Large pieces of fossil wood bored by *Teredina personata* were of common occurrence and also fruits of *Nipa* sp., which were very difficult to extract in good condition.

Two miles to the east at Cheam the previously mentioned Devine's pit showed the lowest bed of the clay above the Reading beds. It consisted of coarse yellow sand with pebbles.

The excavations for the By-Pass road proved that the clay was present at a point just over 200 yards north-east of Cheam Church, and from there the road runs on the clay all the way to Rosehill and on towards Morden. Trenches, for sewer and other pipes, showed a yellowish brown sandy clay in places, while some excavations showed dark brown loam. The clay was very monotonous in character and contained septaria in places. No fossils were found, these being either absent or extremely scarce.

At Spring Close Potteries the basement bed of the clay 2-3 feet thick consisted of brown loam with numerous oyster shells as already mentioned. The basement bed usually contains a number of species of shells but here it yielded only the two species of oyster, *Ostrea bellovacina* and *O. tenera*.

Nearly five miles of the railway line from Wimbledon to Sutton lies on the clay, the Reading beds outcropping near West Sutton Station.

From St. Helier, after a run over level country, the line dips at Sutton Common Station to pass under the road. A section here in 1929 showed 6 feet of brown clay overlying 15 feet of grey clay tinted slightly blue. An exceptionally long period of rain at the time of the excavation made the site very waterlogged and detailed examination was not carried out. A lot of the material excavated was used to build up an embankment at the back of the Sutton Bus Garage, where the line was carried on bridges over two roads. Some of this material was examined but seemed to be devoid of fossils.

The Memoir, page 35, also records an old brickyard near All Saints Church, Benhilton, about half-a-mile south-west of Sutton Common Station, in which septarian nodules were found containing fossils. Seven species of shells were named. The pit has since been built over.

A disused pit at the Wrythe, Carshalton, showed, when visited in 1926, brown clay with much septaria and fossil wood bored by *Teredina personata*. Nodules of "race" (concretions of carbonate of lime) were also seen. They probably arose from the decomposition of shells. This is as recorded in the Memoir on page 35, but there is now no trace of this pit.

At Beddington Lane the clay lies under a covering of gravel and sand roughly 9 feet thick, and has been exposed at temporary exposures at the Sewage Works.

The Memoir, page 35, records a pit near Beddington Lane Halt which was 50 feet deep, the bottom 40 feet being London clay crowded locally with fossils. Four genera of shells are named and also fruits of *Nipa* are listed.

THE BOURNE, UNDERGROUND WATER AND SPRINGS

The chalk, which under Sutton is more than 600 feet thick, is a huge reservoir of water running along a number of fissures at various depths from the surface.

For an unknown but probably vast number of years, after a season of heavy rainfall the chalk reached saturation point, and surplus water overflowed and formed lakes in low lying fields and flooded small dry valleys, the water always coming up in the same places. Under Sutton High Street it burst through the Thanet sand and flooded the cellars of several shops near West Street.

This underground river was known as the Sutton Bourne. It usually rose above the surface every few years and occasionally after a very wet season for two winters running.

During the time the Bourne was up, the brick-yard pit at the Spring Close Potteries between Gander Green Lane and Cheam Church was completely flooded, as were also the adjoining fields, where a huge lake was formed which spread right across what was then called Bourne Hole Lane (now Love Lane).

Another spot where the effects of the Bourne were seen on a large scale was in Nonsuch Park, where an old excavation known as Diana's Ditch became flooded and, overflowing, created a small lake.

Another lake, which sometimes flooded the adjoining road, used to appear in Cheam Park.

Also at Cheam there was much flooding at the foot of the hill on the Malden road. The fields on the west side of the road were waterlogged and small lakes were seen in places. On the other side of the road the pit at Devine's brick-works was flooded.

The Bourne usually rose during the winter period and after a few weeks gradually subsided.

The passage of water in the chalk under Sutton is in a westerly direction and at Ewell powerful springs bring a lot of it to the surface. It can be seen rising in small fountains in the ponds in Ewell village. This is the source of the Hogs Mill river.

In 1922 the Sutton District Water Co. sank two deep artesian wells close to Gander Green Lane, Cheam. These passed through the Reading beds, and the Thanet sand, and were continued deep down into the chalk below. The total depth reached was 200 feet. The details of the boring, as given to me in 1961 by the Water Company, are shown in the table.

BORE HOLES IN GANDER GREEN LANE, CHEAM, 1922

					Feet
	Made Ground	..	..	..	6
Reading Beds	Mottled clays and sand	..	..	..	31½
	Green sand	..	..	..	10
Thanet sand	Hard grey sand	..	..	..	23
Upper chalk	Upper chalk with flints	..	..	..	129½
Total depth					200

The green sand shown in the table was probably the dark green glauconitic loam seen at Spring Close Potteries.

In 1932 an additional well was sunk at this site.

From the time that the wells became operative the Bourne failed to rise, and has not been seen since, and all the flooding has completely ceased. On the site of the lake close to Love Lane, where even in a dry summer the ground was always boggy, the water company has a fine dry sports ground.

Of the three artesian wells in Gander Green Lane, two only at a time are operative. In January 1961 the Water Company informed me that the maximum amount of water they are allowed to pump is one million gallons a day in the summer and two millions a day during the winter months. They take up to the limit and have tried unsuccessfully to get the amount increased.

The water in the wells is reached quite high up in the chalk, but the additional depth catches many more of the fissures in the chalk and makes sure of an adequate supply of water in times of drought.

At the water works in Carshalton Road there are another three wells producing the same amount of water, the maximum allowed. There are also more wells at Woodmansterne for the supply of water outside the Sutton district.

From Woodmansterne northwards down the steep dip slope of the chalk a number of small dry valleys combine to form the large Carshalton Wandle valley. This continues sharply downhill until it finally ends in the grounds of "Carshalton House". As the level of the valley here is well below the water level in the chalk higher up the valley, the water overflows and comes to the surface in a large pond. Here we have the headwaters of the Carshalton Wandle. From this pond the water flows under West Street to unite with the considerable volume of water which outflows from the two large ponds in the village.

In Carshalton Park there are several powerful springs. An artificial excavation, known as the Hog's Pit pond, consists of a deep hollow with an oblong pond at the bottom. It is terraced on three sides and at one end a sort of amphitheatre has been scooped out of the high bank. The exact purpose of this is not known, but the place was evidently some sort of "pleasance".

Several springs are active here after wet seasons, but at times, after dry spells, the pond is quite empty. In January, 1961, following the excessive rainfall of the previous year, a large volume of water was running. Part of this finds its way through pipes to join the large east pond in the village, and the rest joins the water from another spring in the park.

Another small valley comes down from the chalk, on the east side of the Carshalton Wandle valley, and terminates in the park. Here is the "Grotto Spring" so called from the eighteenth century structure erected around it, which consists of brickwork ornamented chambers. There is a little terrace in front of these chambers, and from beneath this the water flows out in three culverts into a broad channel, and runs northwards out of the park and under the road to another pretty pond, from which the water cascades and eventually runs into the east pond in the village.

From the east pond the combined waters, which can now be called the Carshalton Wandle run through the "Grove", a pretty park and sports ground and soon join up with the waters of the Croydon Wandle.

On the north side of Wallington there are a number of springs, all controlled by the local council by means of pipes. Along the Hackbridge road from Wallington Green there are several small ponds which have been enclosed and made picturesque with seats and flower beds. Along one side of the road a tiny brook of spring-water flows through the front gardens, and has been utilized by the residents to form ornamental pools and water gardens.

All the water eventually finds its way into the Croydon Wandle near Wallington Bridge. A number of other springs near Beddington and Waddon feed this river.

THE RIVER GRAVELS

A terrace about a mile north of Carshalton lies at a slightly higher level than the great spread of gravel of the district, and this terrace may be of Boyn Hill age. The Memoir, page 59, records that here, during the construction of the sewage works, a fine skull of a rhinoceros (*Coelodonta antiquitatis*) part of the tusk of an elephant, probably mammoth (*Mammuthus primigenius*) and a number of bones belonging to two or three horses (*Equus caballus*) were found in a deposit, seventeen feet deep, consisting of sand with occasional peaty material.

In 1936 I was living at Oxford Road, Carshalton and the previously

mentioned Carshalton Wandle valley runs through the back gardens of the houses on the east side of the road.

A neighbour in the house next door but one to me, who wanted some gravel for paths, started digging in his garden hoping to find some close to the surface. At a depth of 2 feet he struck solid chalk, below soil and a thin band of stony loam. He then started another excavation 2 feet nearer the house, and this time the chalk was not near the surface, and buff coloured sand was exposed at $3\frac{1}{2}$ feet. At last, after digging through $4\frac{1}{2}$ feet of this sand he reached a bed of coarse gravel. As the trench widened and deepened a wall of chalk was revealed and it became obvious that the excavation was in an old river bed which had been cut into the chalk, and the wall of chalk was one of the original banks. There were only 2 feet of gravel under which solid chalk was encountered. I visited the site on a number of occasions and concluded that this really was the base of the stream, and the river must have actually run over the chalk at this spot. This could only happen if the chalk were completely saturated. This occurs at the present time occasionally, and there is an example in the area under survey. Between Beddington and Wallington the Croydon Wandle actually runs over the saturated chalk for a distance of half-a-mile.

The Croydon Wandle used to flow in a north-westerly direction from Croydon through Mitcham to Merton, and over that area there is a vast spread of gravel over two miles wide in places from east to west. The river was continually silting up its channel, and changing its direction further and further to the west, until to-day it follows a remarkable course due west and at right angles to the chalk valleys, until it joins the Carshalton Wandle and once again turns north.

This large area of gravel is assigned to the Taplow Terrace. It used to be worked in many pits, but, as far as I know, none is now active in the area under consideration.

ACKNOWLEDGMENTS

My thanks are due to the Sutton District Water Company for information about their artesian wells. I am also grateful to C. P. Castell, B.Sc., F.G.S., of the British Museum (Natural History) for his criticism and for reading the manuscript.

Some Notes on the Snails and Slugs of Devilsden Wood and the nearby Downs, Coulsdon

By A. W. JONES and C. P. CASTELL

BEYOND a few papers on the molluscs of Bookham Common, nothing has been published in the *London Naturalist* on the molluscs of the Society's area.

It requires diligent search, on the rather acid London Clay of Bookham Common, to find snails, and the inexperienced beginner might find such an area somewhat disappointing. Devilsden Wood and the adjacent downland is much more productive and it is thought that an account of the habitat preferences and relative abundance of the snails and slugs of this area might help the beginner and encourage some readers to take up the study of the molluscs of the London area and to contribute records.

GENERAL

Devilsden Wood and the nearby Downs lie immediately south-east of Farthing Downs, Coulsdon, Surrey (Grid Ref. TQ (51)/305570). For recording purposes the area of 137 acres has been divided into nine approximately equal divisions lettered A-I (see accompanying map). In the systematic list the name of each species is followed by the number of divisions from which it has been recorded and its known distribution over those divisions. The survey area is a valley running down to the north-west. Broadly speaking the western side is largely taken up by Devilsden Wood, the northern part (F) being on the chalk and the rest (G-I) on clay. A small area (A) to the north of Devilsden Wood and the east side of the valley (B-E) is chalk downland with varying amounts of scrub, some developing into scrubby woodland. A clay downwash extends from Devilsden Wood in G-I on to parts of the grassland in D and E. A series of narrow belts of woodland (shaws) occurs along the highest points of the downland. The area and its vegetation will be more fully described in a future paper.

The scientific nomenclature adopted is that of Ellis (1951) and, for popular names, Ellis (1926).

Voucher shells of all snails (excluding segregates) are in the collection of A. W. Jones, with the exception of *Vertigo pygmaea*, but no slugs were preserved. Where only empty shells have been found in the survey area this is specially mentioned in the Systematic List and where the word shell is used without qualification this implies that there is no definite note of a living animal.

The records from which this paper have been prepared come from two sources:—

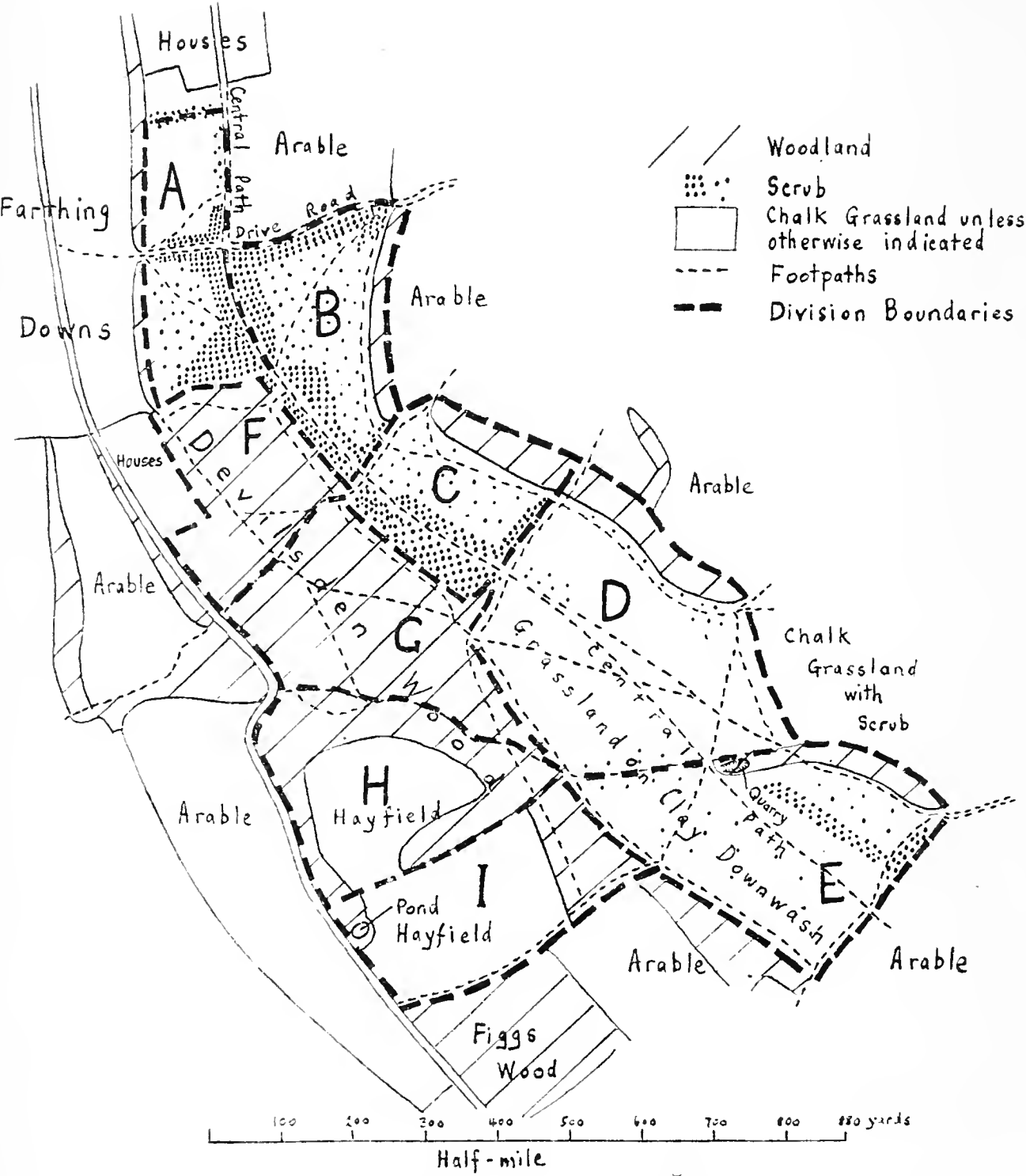
1. Nine general visits made by one of the writers (AWJ) from late 1958 until late 1960, none being made during the summer months.
2. Two whole-day visits made in the autumns of 1958 and 1959 by a party from the Conchological Society, including Dr. H. E. Quick, Dr. M. P. Kerney and the writers, when seven specific sites, forming a chain across the valley, were investigated in detail.

These sites comprised:—

Grassland on clay downwash and on chalk in Division D.

Woodland largely on clay in Division G.

Beechwood on chalk and site near gardens in Division F.



DEVILSDEN WOOD AND NEARBY DOWNS

Snails and slugs are most easily to be found in moss and litter in woods, under stones and piles of vegetation and in turf which needs to be dug up and shaken, but the larger species are often less well hidden. They are chiefly nocturnal, and daytime observations probably do not reflect very well the true populations; statements of frequency given below must, therefore, be considered with this in mind.

THE HABITATS

Snails and slugs are often very local in their occurrence usually preferring micro-habitats such as moss, nettles, leaf litter and under stones where the atmosphere remains humid and the habitats are not subject to extreme changes of temperature.

Land snails are most abundant, both in numbers and in species, on limestone and, in particular, on chalk; consequently the survey area is rich in molluscs, yielding some 45 species.

Bearing this in mind the molluscan habitats may be roughly divided into nine categories:—

A. On the Chalk:

1. Wood in F (27 species).

Frequent—*Cochlicopa lubrica* s.l. (the segregate *C. lubricella* has been recorded).

Occasional—*Pomatias elegans*, *Carychium minimum* s.l. (including the segregate *C. tridentatum*—see also notes in Systematic List), *Ena obscura*, *Helix hortensis*, *Discus rotundatus*, *Oxychilus helveticus*, *Retinella nitidula*, *Agriolimax reticulatus*.

Rare or Local—*Azeca goodalli*, *Acanthinula aculeata*, *Marpessa laminata*, *Clausilia bidentata*, *C. rolpheii*, *Hygromia hispida*, *Monacha cantiana*, *Punctum pygmaeum*, *Arion circumscriptus*, *A. hortensis*, *A. ater* s.l., *Oxychilus draparnaldi*, *O. cellarius*, *O. alliarius*, *Retinella pura*, *R. radiatula*, *Vitrina pellucida* s.l., *Milax* cf. *budapestensis*.

2. Shaws and Scrubby Woods (23 species).

Occasional—*Pomatias elegans*, *Helix hortensis*, *H. pomatia*, *Discus rotundatus*, *O. helveticus*, *Retinella nitidula*, *Agriolimax reticulatus*.

Rare or Local—*Ena obscura*, *Marpessa laminata*, *Clausilia bidentata*, *C. rolpheii*, *Helix nemoralis*, *H. aspersa*, *Hygromia striolata*, *H. hispida*, *Monacha cantiana*, *Arion hortensis*, *A. ater* s.l., *Oxychilus cellarius*, *O. alliarius*, *Retinella pura*, *Vitrina pellucida* s.l., *Milax* cf. *budapestensis*.

3. Scrub (11 species).

Abundant—*Monacha cantiana*.

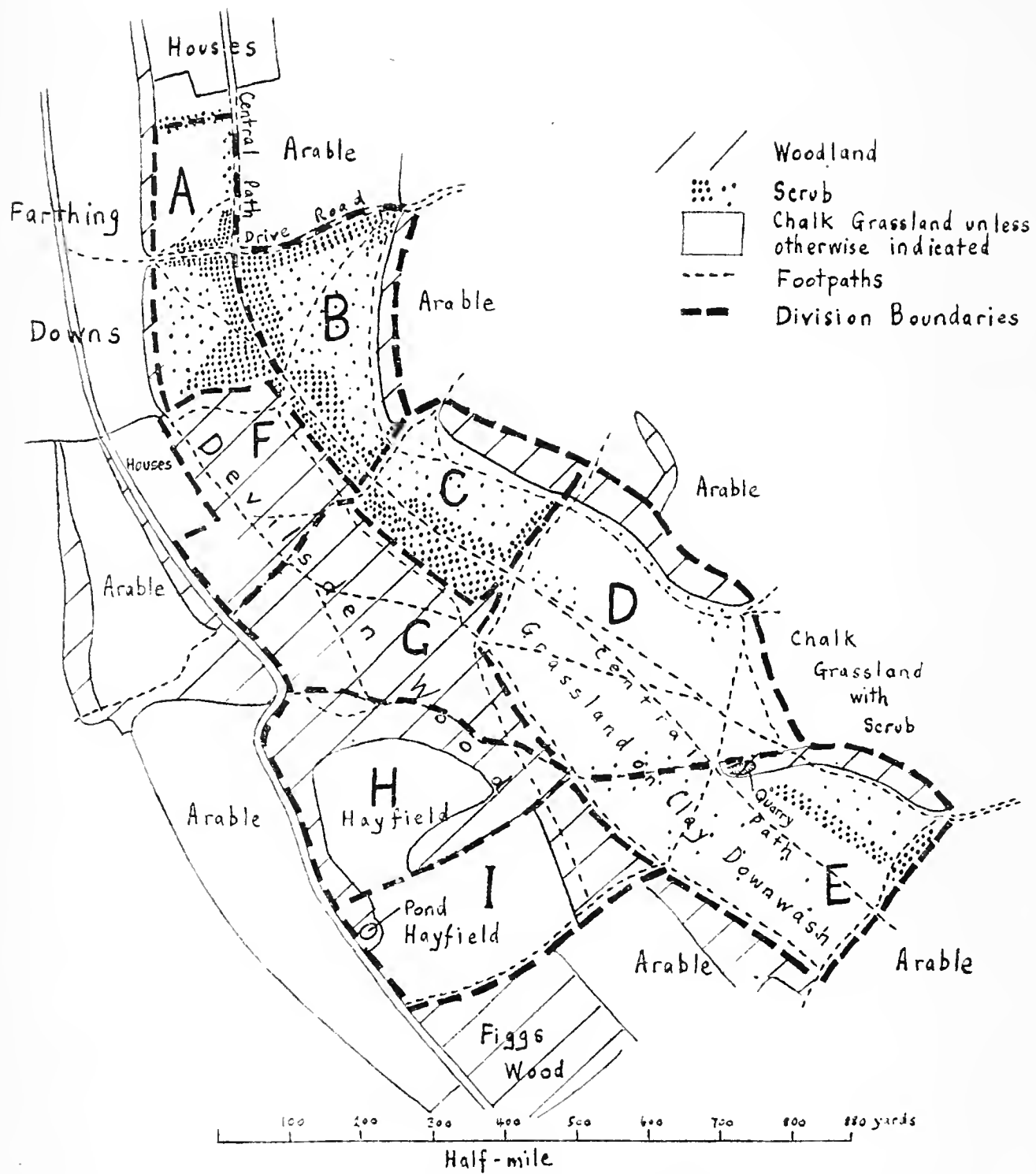
Occasional—*Pomatias elegans*, *Helix hortensis*, *H. pomatia*.

Rare or Local—*Cochlicopa lubrica* s.l., *Helix nemoralis*, *Hygromia hispida*, *Helicella caperata*, *Arion ater* s.l., *Retinella nitidula*, *Vitrina pellucida* s.l.

4. Grassland (27 species).

(a) In chalk grassland many species will be found embedded in the turf (some like *Cecilioides acicula* are found alive probably only at a considerable depth) and it is difficult to estimate their frequency from a few samples of the turf. The frequencies given below are very rough estimates for the smaller species.

Very abundant—*Vallonia costata*.



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Rare or Local—*Azeca goodalli*, *Acanthinula aculeata*, *Marpessa laminata*, *Clausilia bidentata*, *C. rolpheii*, *Hygromia hispida*, *Monacha cantiana*, *Punctum pygmaeum*, *Arion circumscriptus*, *A. hortensis*, *A. ater* s.l., *Oxychilus draparnaldi*, *O. cellarius*, *O. alliarius*, *Retinella pura*, *R. radiatula*, *Vitrina pellucida* s.l., *Milax* cf. *budapestensis*.

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Rare or Local—*Ena obscura*, *Marpessa laminata*, *Clausilia bidentata*, *C. rolpheii*, *Helix nemoralis*, *H. aspersa*, *Hygromia striolata*, *H. hispida*, *Monacha cantiana*, *Arion hortensis*, *A. ater* s.l., *Oxychilus cellarius*, *O. alliarius*, *Retinella pura*, *Vitrina pellucida* s.l., *Milax* cf. *budapestensis*.

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Very abundant—*Vallonia costata*.

ENDODONTIDAE

Punctum pygmaeum (Draparnaud), Dwarf Snail. 2 DF. Two empty shells found, one in wood in F and another in the open on the valley floor in D.

Discus rotundatus (Müller), Rounded Snail. 6 A-C E-G. Widely distributed and fairly frequent by gardens, in woods, and waste places. Scarce in chalk grassland.

ARIONIDAE

Arion intermedius Normand, Hedgehog Slug. 1 D. A few in grassland on chalk and on clay downwash.

A. circumscriptus Johnston, Bourguignats' Slug. 3 DFG. Scattered individuals in woods and grassland.

A. hortensis Férussac, Garden Slug. 6 AC-G. Frequent by gardens in F, local elsewhere; usually in semi-wasteland situations or edges of wooded areas. Not observed in chalk grassland.

A. subfuscus (Draparnaud), Dusky Slug. 2 DG. Noted a number of times in chalk grassland in D, and also in the wood in G.

A. ater (L.) s.l., Black Slug. 5 ACDFG. Local; most frequently seen by gardens in F, elsewhere noted from woods, semi-wasteland places and, perhaps atypically chalk grassland.

ZONITIDAE

Euconulus fulvus (Müller), Tawny Snail. 2 AG. Single specimens from chalk turf in A and from moss in wood in G.

Vitrea crystallina (Müller) s.l., Crystal Snail. 4 ADFG. Shells taken on digging up downland turf in A and D and also recorded under nettles in F and in the wood in G. All specimens examined carefully have been referred to the segregate *V. contracta* (Westerlund).

Oxychilus draparnaldi (Beck), Draparnaud's Snail. 1 F. Abundant by gardens.

O. cellarius (Müller), Cellar Snail. 6 A C-G. Local in woods, rare in grassland.

O. alliarius (Müller), Garlic Snail. 4 ADFG. A number taken in a shady place by gardens in F, local in woods and one specimen found in chalk grassland.

O. helveticus (Blum), Glossy Snail. 7 A-G. Frequent by gardens in F, occasional and widely distributed elsewhere in woods and shaws.

Retinella radiatula (Alder), Rayed Snail. 3 DFI. Single specimens in grassland on chalk and clay downwash, wood on chalk and by pond.

R. pura (Alder), Glass Snail. 5 ABCFG. Occasional specimens in wooded areas.

R. nitidula (Draparnaud), Smooth Snail. 7 A-G. Occasional in woods everywhere. Local in grassland, chalk scrub, and waste places. Specimens with white shells have been taken.

VITRINIDAE

Vitrina pellucida (Müller) s.l., Pellucid Snail. 5 C-G. Widely distributed in a variety of habitats, woodland and grassland, both on and off the chalk. Never in any quantity.

LIMACIDAE

Milax cf. *sowerbyi* (Férussac), Keeled Slug. 1 F. By gardens in company with *M. cf. budapestensis* *M. cf. budapestensis* (Hazay). 2 EF. In company with *M. cf. sowerbyi* by gardens in F, also separately at foot of hill in F in woodland and in quarry in E.

Limax maximus L., Great Slug. 1 H. A single specimen under a log in wood.

Agriolimax reticulatus (Müller), "Field" Slug. 8 A-D F-I. Rather frequent by gardens in F, elsewhere occasionally found in wooded parts, particularly at edges, noted a number of times in open grassland.

REFERENCES

ELLIS, A. E., 1926, *British Snails*. Oxford.

———, 1951, Census of the distribution of British non-marine Mollusca. *J. Conch.*, 23, 171-244. The standard modern textbook, Ellis (1926), is out of print and is expensive secondhand but the beginner may find the following useful:—

ADAMS, L. E., 1896, *The Collector's Manual of British Land and Freshwater Shells*.

REEVE, L., 1863, *The Land and Freshwater Mollusks Indigenous to, or Naturalized in, The British Isles*.

RIMMER, R., 1880, *The Land and Freshwater Shells of the British Isles*.

STEP, E., 1945, *Shell Life. An Introduction to the British Mollusca* (still in print, but practically the same as the 1901 edition, very short and inadequate descriptions).

TATE, R., 1866, *A Plain and Easy Account of the Land and Fresh-water Mollusks of Great Britain*

Books

A Key to the British Species of Freshwater Cladocera, by D. J. Scourfield and J. P. Harding (2nd Edition), 1958.

A Key to the British Freshwater Cyclopid and Calanoid Copepods, by J. P. Harding and W. A. Smith, 1960

(Scientific Publications No. 5 and 18 of the Freshwater Biological Association priced at 4s. 6d. each).

The keys published by the Freshwater Biological Association need no introduction to our members; for many years now they have appeared—and in some cases re-appeared—only as and when publication is fully justifiable and in this way the highest standard has been maintained throughout the series.

Two issues recently received illustrate this point well. It is gratifying to find Dr. J. P. Harding in the first revising *Daphnia* and related genera covered in the 1941 edition which he helped the late D. J. Scourfield to prepare, and in the other, with the help of his colleague W. A. Smith of the British Museum (Natural History) producing a more original series of tabulated keys to species all too often lumped together as “*Cyclops*”. The general biologist may regret the omission of E. B. Worthington's original introduction to No. 5 but he will appreciate the addition of an index; following precedent, perhaps an index will be added to the second edition of No. 18.

It must however be noted that all these creatures are subjects for study only by microscopists keen enough to preserve and mount specimens carefully and ready to be meticulous in examining them, but so much remains to be learnt about them and their distribution that some of our “pond dippers” should seriously consider taking up this line of study. For them, and for anyone desirous of learning more about water fleas (in the wider sense) these two well-illustrated books can be classed as “indispensable”.

J.F.S.

The following are among the books which have also been added to the library during the year:

Christian, Garth, *A Place for Animals* (1958);

Clegg, John, *The Freshwater Life of the British Isles* (second edtn., 1959);

Dowdeswell, W. H., *Practical Animal Ecology* (1959);

Duncan, U. K., *A Guide to the Study of Lichens* (1959);

Hamilton, F., *Let the Forest Judge* (1919);

Hodges, Dorothy, *The Pollen Loads of the Honeybee* (1952);

Hull, M. R., *Roman Colchester* (1958);

Imms, A. D., *Outlines of Entomology* (revised by Richards and Davies, 1959);

Killington, Frederick James, *A Monograph of the British Neuroptera* (2 vols., 1936-1937);

Miller, N. C. E., *The Biology of the Heteroptera* (1956);

Nixon, Gilbert, *The World of Bees* (1959);

Park, Arthur F., *Making Friends with Birds* (1948);

Ribbands, Ronald, *The Behaviour and Social Life of Honey Bees* (1953);

Richards, O. W., *The Social Insects* (1953);

Sage, Bryan L., *A History of the Birds of Hertfordshire* (1959);

Simpson, N. Douglas, *A Bibliographical Index of the British Flora* (1960);

Snow, D. W., *A Study of Blackbirds* (1958);
 Southwood, T. R. E., and Dennis Leston, *Land and Water Bugs of the British Isles* (1959);
 Wheeler, William Morton, *The Social Insects* (1928);
 Williams, C. B., *Insect Migration* (1958);
 also several parts of the Royal Entomological Society of London's Handbooks for the Identification of British Insects; and a number of bulletins of the United States National Museum (Smithsonian Institution).

In addition, several bound volumes of journals, transactions, etc., have been added to the library; and a large number of periodical publications (many of which will eventually be bound) have been received—many of them on an exchange basis.

Official Reports for 1960

Curator's Report

When it was known that redecoration would be carried out in our rooms at Eccleston Square during the summer months, Sections decided to rearrange their collections, which had till now been accumulating under somewhat difficult storage conditions.

The Entomological Section is preparing an introductory reference collection of the British Insecta, A. E. Le Gros is working on a collection of plant galls, and A. S. Wheeler is arranging the Lepidoptera. Several members have presented specimens.

The Ornithological Committee urged that the egg collection, which occupied nine cabinets, should be rearranged with a view to retaining a good reference collection only. This task, which is nearly completed, will greatly facilitate the use of the collection by members. The skin collection is also due for overhaul, and now it is known what accommodation is available every effort will be made to work on the skins this winter. The only addition to the Ornithological collections this year is a skin of Red-throated Diver presented by W. G. Teagle.

K. H. HYATT, *Curator*.

Librarian's Report

Attendance at the Library was affected by the fact that it was closed for practically two months in the summer whilst the decorations were being done. The number of borrowers was 148, and 171 books were borrowed.

Thanks to the legacy left to the Society by the late C. L. Collenette the Administration and Finance Committee were able to provide the necessary funds to instal an entirely new set of shelves, which are a great improvement on the old bookcases, and will accommodate all the books in one room.

The Committee wish to record their thanks to the many helpers who assisted in removing the books and cases while the rooms were redecorated.

For health reasons, I have had to resign the post of Librarian and J. Graham Harvey has been appointed to take my place.

The following Sectional Librarians have also resigned:—Miss Kennedy (Ecology), Mr. Eastwood (Geology), Miss N. Goom (Ornithology), Miss

Scholey (Ramblers) and Miss E. P. Brown from the Rota. The Committee record their grateful thanks to these members for their past services.

The Committee also wish to thank A. E. LeGros for the valuable work he has done in re-organizing the Exchange List. There are now some 49 Societies, etc. at home and eight abroad with whom the Society exchanges publications.

A number of obsolete books have been disposed of to the advantage of the Society funds, and some 170 new books and pamphlets have been added to the Library during the year, some of which have been presented by members (including B. V. Moyle, H. S. Cornwall, A. E. LeGros) for which we are grateful.

In conclusion, I wish to thank the Sectional Librarians and members of the Library Rota for their work in the Library, and attendance at the fortnightly meetings.

J. B. FOSTER, *Librarian*.

Nature Conservation

THE Conservation Committee has suffered a change of personnel during the year. J. F. Burton resigned as Representative for Kent on leaving the county and his place has been taken by Mrs. A. G. Side. After many years' service, R. M. Payne has resigned and Miss D. E. Woods has taken over his duties as Representative for Essex.

The coming year should see a marked strengthening in our liaison with the neighbouring Naturalists' Trusts, H. A. Craw, Mrs. Side and Miss Woods having been appointed by Council as Representative Members of the Surrey, Kent and Essex Naturalists' Trusts respectively. Increased co-operation with the Surrey Trust should result from the election of six of our members to their Council.

The Conservation Corps has continued its good work of scrub-clearance at South Hawke, Box Hill, Bookham Common and the Perivale Bird Sanctuary. This year, the Ministry of Education has made a substantial grant to the Council for Nature to enable it to extend the work of the Corps. An Assistant Organizer has been appointed and it is intended to expand considerably the programme of weekend tasks, especially near large towns. Accordingly, the Society has been invited to submit suggestions for tasks within the Society's area. The Conservation Committee would, therefore, be glad to receive, and to consider, suggestions from members for submission to the Council for Nature.

The Committee has had under consideration the difficulty experienced by County Representatives of covering their county adequately. It is hoped to find members willing to act as observers or assistant representatives covering part of their county and offers of help and reports of local events will be welcome.

Apart from Essex, where there appears to be nothing of note to report, the following is based mainly on reports received from Mrs. W. M. McMullen for South West Middlesex, Professor Warmington for South Herts., Mrs. A. G. Side for Kent and E. W. Groves and the Surrey Naturalists' Trust's News Letter for Surrey.

In HERTFORDSHIRE, there has been much development at Abbots Langley, but without destruction of woodland. Watford, although Hertfordshire's largest town, seems to be no longer quite such a danger

to the Green Belt as appeared likely a few years ago, thanks to an enlightened approach to the problem by the local authorities. The beginning of the M.1 Road near Aldenham was constructed with very little damage, other than cutting through a dense plantation of young trees. The very large gravel diggings in the Moor Mill-Frogmore area have resulted in some attractive lakes worthy of conservation. Groups of trees have been planted by the Colne Valley Water Co. at Hilfield Park Reservoir by the Watford By-pass and the reservoir, which is still kept strictly private, is now a real asset to natural beauty.

The Nature Conservancy asked for the Society's views on a proposal of the Forestry Commission to plant hardwood trees on a small part of Cuffley Great Wood. The botanical interest of the damp areas near the stream was pointed out and a request made that planting should be confined to the drier parts.

The picture in the thickly populated area of SOUTH WEST MIDDLESEX, with few open spaces, is still dominated by the disturbance caused by the building of arterial roads out of London or the threat of disturbance in the future. The majority of these roads will be of motor-way type and the best that can be said is that once the tremendous upheaval of building is over, the parks and commons which they cross will not be littered with parked cars, because there will be no access to the roads except at recognized junctions.

Most of the local councils are now jealously guarding their few remaining open spaces and, where they have opposed applications for building, they have in many cases been upheld by the Minister. The South West Middlesex Group decided not to be represented at a further enquiry regarding gravel-pit development on Hounslow Heath, as the proposal did not involve the use of any more land. They were invited to state their point of view as they had been represented at the original enquiry. The work on Staines By-pass has now begun. Another enquiry has been heard in connection with the Ring Road crossing Osterley Park, the result of which has not yet been made known. The Society was consulted by the Conservancy, but was unable to add to the report, mainly on birds, sent in 1955. It appears that there would be no access from the road to the park, which should minimize interference.

The preservation of open spaces and agricultural land in S.W. Middlesex does seem to depend, in the future, on the lead given to local councils by the Government. How long they will be able to withstand the tremendous pressure exerted by developers in what is a land famine remains to be seen.

No reports relating to KENT were received from our members, but news of nature conservation has come from members of the Kent Naturalists' Trust. The Trust has in hand scrub clearance on Darwin's Orchid Bank at Downe and it is certain that this world famous site will be conserved to the best of the Trust's ability.

Ruxley Gravel Pit is also on the list of places to be conserved by the Trust. In this case a team of naturalists is being gathered together and members of our Society have been approached by the leader of the team to help in a survey of the area. Botanists, an entomologist and a member of the Ecology Section will be visiting the pit at regular intervals to report on what is to be found there and what steps are needed to protect the flora and fauna.

Darenth Wood, a classic entomological collecting place, has come

into the news lately. Representations were made last year to the Trust concerning the damage to the wood done by gipsies living there. This may have had nothing to do, of course, with the events of the last week of November, when the gipsies were conducted from the wood by the local authority.

Turning to SURREY, a serious threat to Esher Common lies in the proposed Esher By-pass which will cut right through the middle of the Common. Both the Surrey Naturalists' Trust and our Society were approached by the Conservancy. The proposed route would be mostly on the higher ground south of the Black Pond and of the boggy area where the scientific interest lies. Very detailed lists of the flora and fauna were prepared by our member K. P. Keywood and sent to the Conservancy via the Surrey Trust. Although the proposed route may not cause immediate damage to the more interesting areas, the ultimate results can only be disastrous, unless great care is taken to confine motorists to the road and prevent parking and general access to the common.

The Surrey Trust is actively supporting the Council for Nature in its efforts to preserve farm and village ponds. A survey of ponds in the county is being made and the deplorable condition of those at Chelsham and on Ham Common has been taken up. The Surrey County Council has appointed a committee to consider the future of commons in the county and is seeking advice from the Trust on the establishment of nature reserves.

The Society for the Preservation of Upper Norwood and District requested our Society's support for their proposal to the Croydon Corporation for turning part of a nine acre wood into a bird sanctuary. This wood, at Beaulieu Heights, is the property of the Corporation and is part of the former Great North Wood. In view of the close proximity of housing estates and associated vandalism, the strong probability of future public access, with the clearing of undergrowth, and the necessity of adequate fencing, the Committee doubted the value of the area as a sanctuary.

A public enquiry was held in May to hear an appeal against the refusal of the Surrey County Council to allow an extension of gravel workings at Slines Oak Wood, Nore Hill, Chelsham, a Site of Special Scientific Interest. The Nature Conservancy offered no objections, apparently under the mistaken impression that the scientific interest of the site was solely geological and that fresh working would reveal new information. The woods surrounding the geological site provide sanctuary for a number of uncommon birds and the Conservation Committee sent a letter of protest to the Inspector of the Inquiry expressing the Society's concern at the inevitable disturbance to the woodland wild life. The Surrey Trust also protested and was represented at the Inquiry. The result of the Inquiry was that the Minister has refused to permit quarrying in Slines Oak Wood except for a very small portion, a not unsatisfactory decision.

Encouraging features of the year's conservation work have been the increased activity of the Kent and Surrey Trusts within our area and the appointment of an Assistant Regional Officer for South East England at the Nature Conservancy, which has resulted in greater consultation with the Society.

C. P. CASTELL.

Statement of Accounts

GENERAL

1959			<i>Receipts</i>					
£	s.	d.				£	s.	d.
1,695	8	0	Subscriptions Current	...	...	1,722	18	4
34	14	0	Subscriptions Arrears	...	...	38	15	0
26	17	6	Subscriptions Advance	...	...	43	0	0
48	15	0	Entrance Fees	...	...	45	17	6
<hr/>						<hr/>		
1,805	14	6						1,850 10 10
—	—	—	C. L. Collenette Bequest	...	...	...	...	100 0 0
—	—	—	Donations	...	...	...	...	5 3 6
14	3	6	President's Fund	...	...	...	...	— — —
2	12	6	Interest £75—3½% War Stock	...	...	2	12	6
5	8	0	Interest £180—3½% Savings Bonds	...	...	5	8	0
15	15	3	Interest Deposit Account	...	...	25	2	6
						<hr/>		
								33 3 0
6	18	0	Rents	...	...	...	...	7 0 0
59	10	6	Sale of Christmas Cards	...	...	...	...	14 5 7
			Balance in hand 31.10.59	...	...	...	...	64 9 2
<hr/>						<hr/>		
£1,910	2	3						£2,074 12 1
<hr/>						<hr/>		

PUBLICATIONS

67	1	7	Sale of Publications	...	...	...	...	62 5 2
—	—	—	Grant from Royal Society	...	...	...	...	65 0 0
10	0	0	Advertisements	...	...	...	...	22 12 0
46	3	3	Excess on reserve for <i>L.B.R.</i> No. 22	...	...	...	...	— — —
751	4	5	Transferred from General Account	...	...	...	...	979 4 9

£874 9 3

£1,129 1 11

13 April, 1961

A. W. JONES, *Hon. Auditor.*H. B. CAMPLIN, *Hon. Auditor.*V. F. HANCOCK, *Hon. Treasurer.*

Year Ending 31 October, 1960

ACCOUNT

1959			<i>Payments</i>						
£	s.	d.					£	s.	d.
162	2	6	Hire of Rooms and Halls	...	...	...	163	3	0
58	9	8	25 Eccleston Square Rent and Cleaning	...	...	...	56	8	2
1	2	11	25 Eccleston Square Gas	...	...	...	5	12	7
3	10	0	25 Eccleston Square Fittings	...	...	...	10	14	0
—	—	—	25 Eccleston Square Decorating	...	...	...	60	19	8
—	—	—	25 Eccleston Square New bookcases	...	...	...	154	19	6
26	19	6	Library grant	...	...	...	25	0	0
84	15	6	Printing and Stationery	...	...	...	67	6	8
192	5	0	General Secretary's Honorarium	...	...	...	150	0	0
28	12	3	General Secretary's Telephone	...	...	...	25	18	9
44	12	6	General Secretary's, etc., Postages	...	...	...	45	19	3
14	3	0	Subscriptions to other Societies	...	...	...	22	8	0
79	10	0	Sectional and Group Grants and Expenses	...	...	...	84	19	6
6	18	9	Insurance	...	...	...	6	18	9
22	13	7	Sundries	...	...	...	13	13	11
79	10	3	Centenary Exhibition	...	...	...	—	—	—
42	16	8	"Birds of the Metropolis" Film	...	...	...	82	13	10
751	4	5	Grant to Publications Account	...	...	...	979	4	9
100	0	0	Trans. to Reserve Account	...	...	...	100	0	0
146	6	7	Deficit 31.10.58	...	...	...	—	—	—
64	9	2	Balance in hand 31.10.60	...	...	...	18	11	9
<hr/> £1,910 2 3 <hr/>							<hr/> £2,074 12 1 <hr/>		

ACCOUNT

118	0	0	Programme, 1960	...	...	...	128	0	0
445	15	2	London Naturalist No. 39	...	...	...	586	0	7
10	6	5	L.B.R. No. 23	...	...	267 11 3			
230	0	0	Less L.B.R. No. 23 Reserve	...	...	230 0 0			
							37	11	3
—	—	—	L.B.R. No. 24 Reserve	...	...	...	270	0	0
19	13	6	Addressing and Wrapping	...	...	...	36	17	10
50	14	2	Postages	...	...	...	70	12	3
<hr/> £874 9 3 <hr/>							<hr/> £1,129 1 11 <hr/>		

The Life Composition Account remains at £400 whilst the Reserve Account was increased from £175 to £275 by a transfer of £100 from General Account.

Sectional Reports

Archaeological Section

In these days of specialization some people consider the presence of an archaeological section in a natural history society to be an anomaly, in spite of traditional connections. It is probably because of this that the Section's programme had not, until recently, included active work and research. Well attended lectures and visits had been organized but no excavations or field work had been carried out and no original archaeological material had been published in the *London Naturalist* for many years. For the past three years or so the committee has been trying to remedy this state of affairs and the keen response obtained has demonstrated that an archaeological section does indeed have a rightful place in a natural history society.

Archaeology has made great technical progress during the last 25 years and to-day the archaeologist is aided by the knowledge and skills of experts in many other fields. To reflect this, many of the lectures, both formal and informal, arranged for the Section have been given by experts in different aspects of archaeological work. These lectures together with visits to excavations, to museums, to archaeological sites and to old buildings have been designed to encourage interest and knowledge amongst members of the Section and to disseminate archaeological information in the Society at large.

Each month an informal meeting has been held at which an invited speaker or a member of the Section spoke on a subject of current archaeological interest. Peter Marsden at one of these meetings explained to members the results of the excavation of the Roman boat at Guy's Hospital, at which some had assisted. On a related topic, Mr. Harvey has on two occasions talked about other boats found in the Thames. To introduce the Section to the work of recording the structural details of buildings threatened with destruction, J. T. Smith of the Royal Commission on Historical Monuments addressed an informal meeting and conducted a visit to Barnet. Plans are in hand to organize a group interested in this work.

In April Mr. Maitland Muller of the Cuming Museum told the Section of the system of archaeological observers he has organized in the Southwark area. Members were invited to help by sending in details of local archaeological exposures. During the building work at present taking place in London, much valuable information will be destroyed unless all persons interested are vigilant.

Information about forthcoming events and lectures is given at the informal meetings in addition to a lecture of topical or general interest. There is always plenty of time for discussion and the proceedings are completely informal. Tea and biscuits are available at a very small cost: the section is indebted to the members who provide this service.

An innovation during the year was a visit as far afield as Colchester. Mr. Turner led a walk round the Roman Walls of the town and some time was spent in the Castle Museum. The day was a success and it is hoped that further meetings at a distance from London will be arranged.

Formal lectures and half-day visits are not being neglected. Mrs. R. A. Cotton, F.S.A., spoke at the A.G.M. on Iron Age Hill Forts, detailing structural features of note. In May, F. J. Collins, a valued friend of the Section, told of his work during the demolition of Holy

Trinity Church in the Minories. Mr. Collins was responsible for the salvaging of much information and material from the site. The newly opened sections on Roman and prehistoric London at the London Museum were toured with Miss Young of the museum staff.

Two study groups have been set up to investigate problems of the Roman road system around London. One group is trying to trace the course of the road from Dunwich while the other is working on the line of Watling Street. Both groups have carried out much basic field work and two small excavations have been made during the year to test theories, one on the former premises of the Licensed Victuallers' Institution in Peckham, and the other at Bush Wood in Wanstead. The results of this research will ultimately be published in the *London Naturalist*. The Section's previous excavations on the line of Stane Street at Morden were published in the *London Naturalist* during the year. Further excavations are being planned and it is intended to include facilities for training the many beginners who have been actively supporting the Section.

The Section is co-operating with other societies mainly through the agency of the Council for British Archaeology, of which it is a member. Two delegates attend each Council meeting and report back to the Section. The Section is also a member of "Group 10", a committee set up by the C.B.A. and comprising representatives from most of the archaeological societies and museums of London, Middlesex, Hertfordshire and Essex. At its meetings recent finds, threats to ancient monuments and old buildings, excavations, etc., are discussed. Through it many useful contacts have been built up.

Two additional members, C. E. Easterling and V. F. Bignell were elected to the sectional committee at the A.G.M. Increasing the size of the committee has enabled the duties of Programme Secretary and Sectional Secretary to be separated. Miss E. Wilson retains the post of Programme Secretary and Mr. Bignell has taken the position of Section Secretary. Many thanks are due to Miss Wilson for her work in both capacities during a period of expansion of the interests and activities of the Section. We are also very grateful for the help given by Mrs. Regan and Mr. Walsh who are retiring from the committee this year.

I. DARLINGTON, *Chairman*. V. F. BIGNELL, *Secretary*.

Botanical Section

The membership of the Section fluctuates from month to month, but has not strayed far from 500 during the past year, the figure at present standing at 495.

The Reading Circle continues to circulate the publications of the B.S.B.I. to nine members.

The Section's programme for the year consisted of 29 meetings. There were six formal lectures, two of them at General Meetings, and the guest lecturers were P. W. James talking on an expedition to Southern Patagonia, Dr. C. E. Hubbard who spoke about Kew Gardens and Miss M. McCallum Webster on botany in Africa. The remaining lectures were given by our own members, one by S. T. Jermyn on British Umbelliferae and two by our Chairman, who discussed some of his own recent botanical experiences. An average of 42 members attended these meetings.

Six informal meetings were arranged to cover a variety of topics and, though the average attendance was only 15, those present showed by

their interest and enthusiasm how much the occasions were appreciated. At two of the meetings, members showed their own botanical photographs and coloured slides. At the others, members had opportunities to study and discuss Grasses, Sedges, Fungi and Umbelliferae. Any member who has not yet paid a visit to the Society's rooms at Eccleston Square should not miss the opportunity to do so that informal meetings provide. New members, in particular, can get to know experienced and keen naturalists in the friendliest way, and this can be of the greatest value to them.

The same is also true of the field meetings, of which 17, some of them held jointly with other Sections or other Societies, were included in this year's programme. In February, a meeting at Leith Hill for bryophytes and lichens was well attended and the long list of species seen that day included *Hookeria lucens*, a very striking moss, which some of the beginners present mistook for a leafy liverwort, until the abundant capsules were pointed out. Visits were made to the Botany Department of the British Museum (Natural History) and to the South London Botanical Institute. On an excursion to the Chess Valley in May, members saw Coral-wort (*Dentaria bulbifera* L.), a very local plant of the family Cruciferae. Seven species of orchid were seen in flower on the chalk hills at Otford in June. Some 40 species of flowering plants, including Slender Hare's-ear (*Bupleurum tenuissimum* L.), were examined on and around the salt-marshes at Allhallows in September. In October, there was an excursion to Brentwood, arranged jointly with the British Pteridological Society, when Soft Shield-fern (*Polystichum setiferum* (Forsk.) Woyнар) was seen. This species had been re-discovered at the site only a short time before our visit, after having been considered extinct in Essex for many years. Later in the month there were two Fungus Forays, one in Epping Forest and one at Burnham Beeches, where these curious and puzzling plants aroused great interest, the wet weather this year having encouraged a vigorous growth of toad-stools of all kinds. In addition to those already mentioned, there were field meetings at Bayford, Shoreham, Hatfield Forest, Twyford, Box Hill, Ruislip and Chipstead, where members could meet old friends and make new ones, both among themselves and in the plant kingdom. The numbers attending field meetings varied between six and 36 and averaged 17.

It is pleasing to recall that in a year of floods and heavy rain only two meetings were seriously hampered by adverse weather conditions, though one of these, a visit to Benfleet in October, was abandoned at the outset.

The Section's warmest thanks are due to all those people who have given so generously of their time and their knowledge to make our meetings, both indoors and out, such valuable and enjoyable occasions.

Our Chairman has expressed the wish to retire at the end of this, his second year of office. The Section will wish to thank him most heartily for his services. He will, however, continue to act as the Section's Recorder for Vascular Plants and as Representative on Council, so that the committee can still look forward to enjoying the benefit of his valuable advice. To succeed him your committee nominated J. H. G. Peterken, who has served the Section continuously since 1943 as a committee member, and since 1947 as Recorder of Bryophytes.

Mrs. B. Welch, the Section's librarian since 1955, has also expressed the wish to retire and proposes Miss D. W. Fawdry to succeed her. Whilst thanking Mrs. Welch for her past services, we are pleased to report that she has agreed to continue to serve on the committee.

The only other changes this year are the nominations of Mrs. J. E. Smith and A. C. Jermy to the committee, where their knowledge and experience in field work will be of great value.

Since the end of the first phase of the B.S.B.I. mapping scheme, the committee have been conscious of the need to provide a lead for the many members of our Section who are keen to make some contribution to the scientific knowledge of our area. It is proposed to investigate the distribution of the species of *Calystegia* in the London area. Every member will be able to help and it is hoped that many will do so. Details of ways and means will be published during 1961.

J. E. LOUSLEY, *Chairman*. P. C. HOLLAND, *Secretary*.

Ecological Section

The work of the Section, as for the past 19 years, has been mainly concerned with the survey of Bookham Common. Last winter the Conservation Corps, under the leadership of Brigadier E. F. G. Armstrong, carried out the clearance of about two acres of the scrub of Central Plain, and this year, after consultation with the survey team, further work has been arranged.

Members are strongly urged to take advantage of this opportunity of studying and recording the effects of the clearance on the flora and fauna. The present team is faithful but small, and new workers would be most welcome.

This year the annual visit to Headley Heath has been paid, and a summary produced of the work that has been done in the last ten years on the regeneration of the vegetation on the denuded gravel areas.

Lectures have been varied and interesting, and included "Vole Damage in the New Forest", and "A Holiday in Shetland", by Oliver Hook, "Introduced Vertebrates in the British Isles", by R. S. R. Fitter, "Arctic Sweden", by E. W. Groves, "Otters", by H. G. Hurrell and "The Evolution of Warning Signals in Insects", by Dr. A. D. Blest. Members also gave accounts of work done at Bookham and Coulsdon and C. P. Castell spoke on the work of the Council for Nature.

Informal meetings were held on the subjects of Marine Biology, Fish in the London Area, Dormice and Bats.

Mammal Study Group

A. C. Wheeler continued as Chairman of the Mammal Study Group but Miss M. Pugh replaced Mrs. R. E. Parslow as Secretary, and W. G. Teagle took over as Recorder of Mammals, Reptiles and Amphibians.

Field excursions were made to see bats at Godstone and a remarkable private collection of live British mammals at Effingham, through the hospitality of W. G. Kingham. F. J. Speakman led a most successful visit to Epping Forest for deer.

Mrs. R. E. Parslow has continued to work on the analysis of owl pellets, and Longworth small mammal traps were used to investigate the small mammal populations of Lower Wood, Claygate and Dulwich Woods. With the help of the Young Naturalists' Section, the Lewisham Natural History Society and members of the University of London Natural History Society a start was made on a survey of the distribution of the badger in the London area. The Infestation Control Division of the Ministry of Agriculture, Fisheries and Food gave considerable help in an enquiry into

the distribution of the fox in the Society's area. Both these surveys will be continued over the next few years, and members are invited to send any relevant information to the Recorder.

It is hoped that many more records of other mammals, reptiles and amphibians will be received from members than are being submitted at present. Records of common species, such as hedgehog, grey squirrel and rabbit are just as welcome as those of rarities. It is a remarkable fact that more information is being received at the moment from outside the Society's membership than from within it.

E. M. HILLMAN, *Chairman*. M. E. KENNEDY, *Secretary*.

Entomological Section

Interest in the Section's activities continued to be maintained throughout the year although the membership fell slightly. The indoor lectures were well attended despite the rather specialized nature of some of the subjects. These included: "The Natural History of some Oak-wood Insects" by Professor G. C. Varley; "Evolution of Social Habits in Insects" by our Chairman, Dr. J. Cloudsley-Thompson; "Collecting Equipment Past and Present" by R. L. E. Ford; "Cuckoos of the Insect World" by G. J. Kerrich; "The Locust Problem" by Dr. R. F. Chapman and "Pursuit of Sawflies" by R. B. Benson.

The informal meetings continued to be varied but with an increasing emphasis on the Coleoptera. Topics included evenings devoted to identifying Coleoptera, insect setting, a discussion on insect parasites and predators, a talk by A. A. Allen on "Habitats of Coleoptera" and a preliminary report on the stag-beetle survey by D. G. Hall. Indications are that this beetle is more widely distributed than was at first thought and it has been decided to continue this survey on a wider basis for at least one more year. During the year many members kindly donated specimens to the collection and it is hoped that the special introductory cabinet may be completed during the coming winter.

Some favourite localities were visited during the year including Bookham, Brentwood, Horsell and Oxshott. At the last named two local weevils, *Phyllobius calcaratus* F. and *Curculio betulae* Stephens were taken. Less frequently visited sites included Chipstead, Shoreham and the River Stort near Harlow. Use was made of Ramblers' Excursion trains to visit sandy heaths near Corfe Castle in spring and Matley Heath and Bog (New Forest) in the autumn.

In July our Chairman, Dr. J. Cloudsley-Thompson, left this country to take up his appointment as Professor of Zoology at Khartoum University and we should like to place on record our thanks for the help and encouragement he has given us in recent years.

J. F. SHILLITO, *Chairman*. D. G. HALL, *Secretary*.

Epping Forest Field Section

During 1960 there was an average of two field meetings a month, several of which were led by specialists and all of which were popular, so once again the aim of the committee will be to make the field meetings as diverse as possible both in subject and locality. No mention will be made in this report of the weather during 1960, which rather depleted our ranks, except for the usual die-hards who accept the elements as part of the hazards of pursuing natural history.

At the A.G.M. the lecture was given by the E.F.F.S. chairman, A. G. Leutscher. This was an intriguing account of the changes that could take place in an imaginary garden through the years from 1800 to the present day, entitled "The Suburban Garden as a Nature Reserve"; it was illustrated by charts and specimens.

Lastly once again may we say how grateful we are for the willing help of the leaders and also for the various suggestions we have received.

J. JONES, *Secretary*.

Geological Section

The wet weather of the past year has no doubt played a part in limiting attendance at some of the field meetings, but indoor meetings have on the whole been well attended. For the first time the Section showed an exhibit at the annual reunion of the Geologists' Association. Appropriately the exhibit consisted of selections from the geological exhibit of the Society's Centenary Exhibition. It is hoped that it will be possible for the Section to present an annual exhibit at future G.A. reunions.

Twenty-eight meetings were held. Once again a field meeting was held at Easter. This one, arranged in the Birmingham area under the direction of R. E. Butler and Miss E. Wheeler, was specially planned to cover most of the older rocks so rarely visited by the Section. Among localities visited was the classic area of the Wren's Nest at Dudley where the Wenlock Limestone yielded large numbers of fossils including trilobites, brachiopods and corals. Fossils collected on two other days of the meeting included corals from the limestone of disputed age (Woolhope or Wenlock) at Kendal End. A brief visit was also paid to Hartshill in Warwickshire where the famous Woodlands quarry once yielded the oldest recorded fossils of Cambrian age. Near Lickey members were able to see the Bunter pebbles *in situ* and not, as the Society would usually meet them, in the form of glacial erratics.

One of the few well attended short field meetings was in May to the Tunbridge Wells district. Besides the classic fault at Quarry Hill, Tonbridge, an interesting feature was seen at High Brooms where the living horsetail, *Equisetum*, was growing on Wadhurst Clay, a few feet away from the remains of the fossil horsetail, *Equisetites*. The best attended field meeting of the year was a joint one with the Botanical Section to Boxhill and was under the leadership of Dr. Dalby and Miss Dalby. Other field meetings held ranged from a further visit to the gravel pit at Twickenham to coastal sections in the Cretaceous near Hastings and Folkestone. During April the Section once again visited the Aylesford area and from the Pleistocene gravels there one of the members discovered and extracted an elephant's tusk, an object which might be described as a comparative rarity.

Two of the year's indoor meetings dealt with palaeontology. One of these held in February was given by Dr. Gwyn Thomas and dealt with methods used in palaeo-ecology. An important theme of this talk was the vital need for careful observation before removing a fossil since this would frequently provide useful information on the behaviour of the creature whilst living. As a contrast, C. W. Wright gave, in April, a talk entitled "Twenty-five years of collecting from the Cretaceous". Mr. Wright described many aspects of the vast amount of collecting that he had done and showed a large selection of some of his more important specimens.

Several demonstrations were arranged for the winter months. The highlight of these was a visit to the South Western Stone Co's works at Vauxhall. Here one was able to see many aspects of the building stone industry ranging from architectural planning down to the preparation of the stone for use. All those who attended received free hand samples of various building stones and a delightful booklet dealing with Portland stone. A copy of this booklet has been placed in the Society's library.

The photograph albums are now taking shape and are in the capable hands of Mr. Le Sueur. Photographs of exposures in the Society's area would be welcomed from members.

One of our former members, Julian Hollis, who has now returned to Australia, has had the exceptional good fortune of discovering a hitherto unknown rock. He was given the honour by Melbourne University of naming it. He has called it Anakiete since he discovered it on Mount Anakie near Melbourne.

The thanks of the Section are, as always, due to those who have contributed to its activities during the year and to owners of properties visited who have in every case readily permitted entry.

R. E. BUTLER, *Chairman*. J. D. UNDERWOOD, *Secretary*.

Ornithological Section

Following a vigorous weeding-out of lapsed subscriptions, the total membership of the Society decreased slightly during the year and this downward trend was reflected in our own sectional membership figures which showed a drop of 52 from 1,160 to 1,108 members. Returns for the latter part of the year, however, showed an upward trend which, it is hoped, will be maintained.

The usual wide range of subjects were covered by our indoor meetings and in addition to bird films, which continue to be very popular with members, excellent lectures on Migration, Studies of Individual Species, and Ornithological Experiences both at home and abroad were given, several by our own members. The meeting in September on the London Migration Watch, which the speakers were organizing on behalf of the Research Sub-Committee, introduced many members to a fascinating and rewarding organized field activity.

Informal meetings were even more popular this year and are now a well-established feature of our programme. Subjects this year included identification hints on confusing species and talks on the B.T.O. and the R.S.P.B., while two meetings were devoted to sound recordings of bird calls and song.

An equally varied outdoor programme was provided for members and a wide variety of species were seen on the 47 field meetings undertaken. Most of the meetings were to places in London or the Home Counties but occasional sorties were made by coach or train to the Kent, Essex and Sussex coasts and even further afield to Suffolk and the Wildfowl Trust in Gloucestershire. Another successful week-end ringing course for members was held at Dungeness Bird Observatory on 7/8/9 October and the party ringed over 100 birds of 15 species. Once again the Section made a grant to the Beddington Ringing Station where Mr. Milne and his team ringed a total of 2,064 birds of 48 species, and continued with their study of the variant yellow wagtails.

In a year when one of our own members, R. E. Scott, became the Warden of the Dungeness Bird Observatory, we again made a grant to the observatory in the management of which we share.

Changes in editorial and recording personnel during the year resulted, not surprisingly, in the late publication of the 1958 L.B.R. which was, however, well worth waiting for. The Bulletin also maintained its excellent standard with a growing band of members supplying bird notes. The Editor, R. P. Cordero, was assisted this year by Tom Gladwin who, in his capacity as Bulletin Treasurer, brought the total circulation up to 220; but more support is deserved.

In accordance with the Committee's decision, the rearrangement and necessary pruning of the egg collection has been almost completed by the Curator and will, eventually, greatly facilitate use by members.

Even fewer books were borrowed from the Ornithological section of the library this year, although this may, in part, have been caused by the disruption of the library during the period of redecoration. However, now that the rooms at Eccleston Square have been refurbished and the books attractively re-housed it is hoped that more members will be induced to use our excellent library.

The overall financial position of the Reading Circles showed a slight improvement this year although more subscribers are still required, particularly for the *British Birds* Reading Circles.

The London bird film, which Raymond Cordero and Bill Park are making under the guidance of the Film Sub-Committee, made real progress this year and about two-thirds of the film has now been taken and copying and editing have begun. The major task this year was the erection of a pylon hide, kindly loaned by Eric Hosking, on an island at Walthamstow Reservoirs to film the nesting herons. The film has already attracted a good deal of press publicity which led to the showing of extracts on the B.B.C. programme "Tonight".

It was decided that the Section should not engage in any practical work at the Claygate Sanctuary this year until K. P. Keywood had made a thorough survey of the wood for one year. His report will be considered, as will another most useful report on the wood made by L. Manns, by the Research Sub-Committee who will make proposals for a future programme of action by the Section. Members interested in working in the Sanctuary are invited to get in touch with Mr. Manns.

At the 1960 A.G.M. Mr. Baker retired from office and W. D. Park became Chairman. In doing so, Mr. Park relinquished the Secretaryship of the Section which was assumed by Mr. Cordero who also retained his position as Editor of the Bulletin. D. I. M. Wallace continues as Editor of the L.B.R. and combines this position with that of Chairman of the Records Committee but will be assisted editorially by Messrs. Colston, Homes and Sage.

During the early part of the year R. E. Scott left the area and the post of Recorder for the South of the Thames and the River Thames thus became vacant. P. R. Colston kindly assumed responsibility for those areas, in addition to his own as Recorder for the North, until the vacant post was filled in the Summer by M. J. Carter.

The composition of the Sales team at the publications table was again changed during the year when P. J. Morgan and R. C. Righelato replaced Miss Hawkes and Miss Yeld, Mrs. Roberts remaining as a member of the Sales team.

D. V. Freshwater kindly agreed to act as Auditor for a further year.

Miss Goom, our Librarian, Miss Brown the Reading Circle Secretary and Mr. May the Field Meetings Secretary all expressed a wish to retire at the end of the year from the posts which they had managed so successfully for a number of years. These posts were filled at the A.G.M. by Mrs. P. Trenamen, K. A. Beckett and E. C. Dickinson respectively.

Notices of resignation were received in the latter part of the year from J. F. Burton, who has now moved to Bristol, and from the Junior Member, J. H. Brock, who has gone to Cambridge and under the three year rule Mr. Hayman and Mr. Homes retired from the Committee. These vacancies were filled at the A.G.M. by Messrs. L. Baker, B. S. Nau, P. J. Sellar and R. C. Righelato as Junior Member, who are all welcomed to the Committee.

Once again our thanks are offered to all sectional officers and Committee members for their support and assistance during the year.

L. BAKER, *Chairman*. W. D. PARK, *Secretary*.

Ramblers' Section

Our 1960 indoor meetings opened with a lecture by B. Langford who spoke on "Silver, the Home and You" which was followed by a lively discussion and examination of valuable pieces. In March, W. T. Stearn gave us his experiences as a "Naturalist in Jamaica". The General Meeting on 7 June was on "National Parks" and given by Miss Searle, a lecturer from the Commons, Open Spaces and Footpaths Preservation Society. At the Sectional Annual General Meeting, A. Seymour French gave us a talk entitled "Mainly Mountains" which was illustrated by beautiful coloured slides.

The usual number of excursions were held during the year. Eight were rambles and five were visits to places of interest in London. The districts visited included Tadworth, Knockholt, Berwick, by Ramblers' Excursion train, the Chilterns and Fyfield. An average of eight attended these Sunday excursions. Attendances at the indoor meetings on Saturday afternoons were very good, especially at the Greek Cathedral in January, the Silver Galleries in February and Battersea Old House in December. The average number was 24. The Patent Office on the evening of 13 October drew nine people.

The section has suffered a loss by the death of E. C. Sills who was a member of the committee and a leader of rambles.

At our Annual General Meeting there were considerable changes in the personnel of the Section's officers. C. Weeks follows Miss D. R. Nutting in the post of Chairman. Mrs. S. H. Wood takes the place of Miss L. J. Johns as Secretary. Miss D. E. Woods succeeds Miss R. Davis as Programme Secretary. Miss J. M. Stainton now fills Miss M. Scholey's post as Librarian. C. Weeks will replace Miss R. Davis as a Member of Council.

We would like to express our thanks and appreciation to Miss R. Davis for all the work she has done for the Section since she joined the Society.

DULCIE R. NUTTING, *Chairman*. L. J. JOHNS, *Secretary*.

South West Middlesex Group

It is regretted that for the first time we have to report a fall in the

number of paid-up members, the present total being made up of 61 adult members, seven junior members and one affiliated Society. The interest of members does not seem to have waned however; average attendance at indoor meetings was 18 and nine for field meetings. Seventeen students enrolled for the University Extension Course on British Mammals at Hounslow.

A very worthwhile field excursion was arranged by E. Milne-Redhead, F.L.S., to Old Winchester Hill Nature Reserve in June. Thanks are also due to the Reserve Warden, who went to much trouble to illustrate the Reserve to us. Several interesting orchids were seen.

Our area still reveals an abundance of interesting observations for the ornithologist, such as the following:—

Evening, 5 May: Grasshopper Warbler, Bushy Park, Miss E. Goom.

Early in the year: flock of 50 Bramblings, Hanworth, Mr. and Mrs. Small

20 August: flock of 300 Lapwings, Staines Moor, Group Field meeting.

Mogden Drainage Works: 4 lapwing nests, C. W. Pierce.

Isleworth Eyot: 1 heron's nest, E. Milne-Redhead.

An interesting study is being made at Ashford Gravel Pits, by Miss N. Goom and a few Group members, of the ecological changes occurring as the result of gravel excavation and the replacement with a large expanse of water and plant recolonization. This study is all the more interesting since Miss Goom made a study of this area ten years ago. Already three new records are noted, i.e. the Gadwall, Lesser Whitethroat and Oyster Catcher. There is a good deal of scope here for interesting ecological study, and Miss Goom would appreciate the help of anyone who is prepared to visit the area at frequent intervals.

Our entomology recorder, C. W. Pierce, continued to record butterflies and moths seen in the area and would be pleased to help any members interested in Lepidoptera. More species have been noted, the total of Macrolepidoptera since 1952 being now 274. It is pleasing to record that many species only occasionally noted have been observed this year.

Our thanks are due to the Group Committee and Officers for their active interest during the year, and also to leaders of field meetings and speakers at indoor meetings. We are especially grateful for the unfailing help of our Chairman during the year.

A. ANDERSON, *Chairman*. E. EVERITT, *Secretary*.

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